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ANCIENT INDIA

Number 2 — July, 1946

School of Archaeology.

NOTES

1. The present issue of *Ancient India* includes a paper to which special editorial attention may be drawn. It relates to a site known as 'Arikamedu', near Pondicherry on the tropical Coromandel coast, where local French antiquaries have been digging intermittently in recent years, and where, by generous permission of the French authorities, the Archaeological Survey of India conducted a short but intensive excavation in the burning months of April, May and June, 1945. The results of that excavation are of a potential importance out of all proportion to the extent of the work.

2. To appreciate this importance, it is necessary to recall two things: first, the remarkable extent of the archaeological material recovered during the past century in a variety of ways from a variety of pre-medieval sites in South India; and secondly, our abysmal ignorance of the context, cultural and chronological, of the greater part of the material in question. There have been a few industrious pioneers and collectors—notably Rea and Foote—who have dug from time to time from an honest curiosity or as a mode of collection. But the value still attached to the collectors' catalogues (where catalogues exist) is a measure no less of our lack of basic knowledge than of an invincible zest for it. For these catalogues, however well intentioned, do not contain, save in the broadest and vaguest sense, even the raw stuff of constructive science. Their contribution to knowledge—a contribution for which a proper gratitude is due—is restricted to the presentation of disjected phenomena which they neither explain nor correlate. It is matter for regret, not for congratulation, that the Arikamedu excavation of 1945 was almost the first occasion on which the normal principles of modern archaeological field-technique have been applied in South India.

3. North India has been better served. Taxila, Mohenjo-daro, Harappā, Chanhu-daro are all (or shortly will be) the subject of monographs which record considered field-work and research during the past thirty years. Nothing of this sort is available for the South. And yet historical conjecture, both inside and outside India, has for many years dwelt upon the possible significance of the 'Dravidians' of the South in the development of Asiatic civilization: of supposed links between them and the Sumerians, with the Brāhui of Baluchistan as an isolated memorial of former movement, one way or the other, between South India and Western Asia. To archaeologists the detailed resemblance of some of the megalithic monuments of South India to others of Western Asia, North Africa and Europe has long been an alluring and baffling problem—alluring as presenting a possible link in the early development of human thought and expression extending half-way round the world; baffling because we still know less about these monuments in India than in any other country. It is high time that tropical India had a place in the sun.

4. In this connection it may here be recorded incidentally that the great problem of the megaliths of South India has now at last been taken up in earnest by the Archaeological

Survey. An officer, recently appointed for the specific duty of dealing with the prehistoric monuments of India, has been given the primary task of investigating and classifying the megaliths and urn-fields of the South, and has now been at work for several months with substantial results which will be described here in due course. The task is a long and involved one, but, if carried to its conclusion, will undoubtedly succeed in producing at least a considerable part of the missing information. Meanwhile, in the present number Mr. Srinivasan approaches the problem from a study of the ancient Tamil literature bearing on the subject.

5. This brings us back to Arikamedu. The special value of the site lies in the fact that, in addition to being an Indian town and port, it was also a centre of trade with the Graeco-Roman world, and the relics recovered from it include pottery and other objects of known origin and date from the much-studied Mediterranean area. The associated Indian culture is thus dated with precision, and thereby achieves the distinction of being the first ancient Indian culture to be dated archaeologically in the Indian peninsula. In effect the site is culturally a 'bilingual' one; the unknown local culture is dated from the known foreign culture, just as Egyptian hieroglyphs were partly deciphered from the parallel Greek version on the Rosetta stone, or Kharoshṭhī from the bilingual inscriptions on the Indo-Bactrian coins. It is not, of course, claimed that Arikamedu will in any sense rival the far-reaching historical importance of the former of these analogues; but in its way it will have a significance of a comparable kind. For the first time it provides a firm datum-line from which the classification of pre-medieval South Indian cultures can begin. Already sites in the Chitaldrug district of northern Mysore take the Arikamedu chronology half-way across the peninsula, and incidentally hold out the possibility of stratigraphical contacts with an adjacent megalith-culture; whilst these sites in turn link up with others in the southern part of the Bombay Presidency, and so carry the chain of evidence from sea to sea. To the north-east, analogies noted at the famous site of Amarāvatī bring a capital city of the Āndhra country within our compass. It may be prophesied that future work, planned methodically and executed with discrimination, will quickly establish the widespread usefulness of the three months' digging carried out last year at Arikamedu.

6. Another article in this number provides the context for a series of new photographs of an early medieval sculpture which is familiar to all students of Indian art and iconography but is peculiarly difficult to illustrate in a fashion worthy of its high distinction. Set deeply in their niche within the great cave-temple of Elephanta Island, the gigantic rock-hewn heads of the triple Śiva impend upon the spectator in the dim glow of oil-lamps or in unalleviated gloom; brooding and awesome in a twilight of the gods. Even the experienced skill of Dr. Kramrisch and Mr. Neogy have scarcely succeeded—nor would they claim to have done so—in subduing the mechanism of the camera to the mystery of the scene; but they have wrought with more success than their predecessors, and their photographs are the best yet published of this elusive theme. Furthermore, the opportunity is taken by Dr. Kramrisch to re-study the iconography of the group.

7. For the rest, space has been given to the reproduction of a recent address on the scientific aspects of modern archaeology. At a time when scientific development has become almost a synonym for 'progress' in the planning of India's future, it is worth proclaiming that the study of Man himself is not without its needs in this category. Indeed, the old platitude of the indivisibility of Past, Present and Future has been brought home afresh in recent years by the scientific investigation of phenomena such as food-plants or blood-groups—studies which are now almost as germane to Archaeology as to Agriculture, Health or Post-war Planning. The modern requirements of archaeology do not of course end there. To-day, dynastic history and legend, language, epigraphy and numismatics, no longer monopolize the investigation of the human past. Vast ages vital in the development

of the cultures and civilizations of India exclude all these studies. Let us not forget the traditional curriculum, but let us constantly remember the need for enlarging its scope, for enquiring into the material things—climate, geography, the changing courses of rivers, rocks and their minerals, the soils of varying fertility—which have shaped the destiny of Man and must be understood if we are to understand him. Archaeology in India is blest with a wealth and variety of material unsurpassed elsewhere in the world. With a proper effort, it can rival that of any other country. But a primary need is an enlargement of outlook, a fuller comprehension of the natural sciences as ancillaries to humanistic research : a more sustained urge on the part of our students of archaeology and history to supplement the study of the great literature which they have inherited by exploring, at first hand, the Good Earth which is India and is a heritage no less relevant to their enquiry.

R. E. M. W.

THE IMAGE OF MAHĀDEVA IN THE CAVE-TEMPLE ON ELEPHANTA ISLAND

By Stella Kramrisch

The great rock-cut Śiva temple on Elephanta Island is one of the best-known monuments of its kind in India, by reason partly of the grandeur of its sculptures and partly of its proximity to Bombay. Nevertheless the colossal carving of triple-headed Śiva which looms out of the rock in the innermost recess of the cave has never been adequately illustrated. The dim, unemphatic light which gives it an added quality of power and mystery does not facilitate the task of the photographer. Recently, however, Mr. Prithwish Neogy, one of Professor Stella Kramrisch's pupils in the University of Calcutta, experimented with sun-reflectors and artificial light and supervised the taking of a number of new photographs, some of which are here reproduced (pls. I–VII).

The triune head which, with its shoulders, rises to a height of 17 feet 10 inches above a moulded base, itself nearly 3 feet high, faces the principal (northern) entrance of the temple at the end of a double row of seven pillars. This vista in fact cuts across the major structural axis, which lies east and west, with the liṅga-shrine standing free within the western end (fig. 1). Nevertheless the huge Śiva panel is the focus of the whole design. Like the doorways of the shrine itself, it is guarded by dvārapālas or doorkeepers, each some 13 feet high. Behind, two pilasters flank a recess 10½ feet deep, within which the heads emerge cliff-like from the native rock. In the highest relief, they have at the same time a proper attachment to their material environment and something of the independence and imminent mobility of sculpture in the round.

This is not the context in which to discuss the plan of the temple or the features of the other sculptures which adorn it. Suffice it to say that, though not dated by inscription, the type of column used, with āmlā capital and circular fluted shaft springing from a rectangular pier, is of a kind which was in use at Bādāmi in the latter part of the sixth century A.D. and was still in use at Ellora two centuries later. On this evidence the cave is ascribed to the seventh or eighth century A.D. The more subjective evidence of sculptural style may be thought to point to the earlier of the two centuries. Certainly the bold and vital handling of mass is consistent with the age which, alike in the south and the north of India, saw the first complete fulfilment of medieval art.

The image is that of Śiva in the form of Maheśa, the Great Lord. In the following article, Dr. Kramrisch re-interprets the iconography of the work.

THE great sculpture of Mahādeva is an image of the fully manifest Supreme Śiva. In the middle is the face of Tatpurusha; the faces of Aghora and Vāmadeva are collateral.

The breadth of the shoulders belongs to the central face; the chest, showing but the slightest modelling, is smooth and young. It is as if breathing and holding the breath, as is shown by the ebbing curves of the necklace laid on its raised surface. It is hemmed in on the right and the left by the hands; the right hand is raised—it is damaged; the left rests on the base and holds a ripe fruit with its point up. The shoulders are also those of the lateral faces. These are turned against them, and it is on their backs that their hands come to rest. The one on the spectator's left, belonging to the wrathful face, has a serpent rearing its head from between its fingers, while the one on the right, belonging to the blissful face, holds a lotus flower and is delicately poised on the shoulder. Thus beset with emblems and hands, their fingers pointing upwards in the middle of the bust,

closing in where they rest upon the shoulders, the broad body fills the width of the recess like an altar beset with offerings.

The middle boldly projecting, the frontal image surges upwards straight and strong as a pillar, with silence on its face and radiance on its crown. The heads on the right and the left repeat the ascent of the central pillar, clinging to it collaterally with their high curving crowns, and forming with it the outline of a strong triple arch which firmly binds together the outline of the triple image.

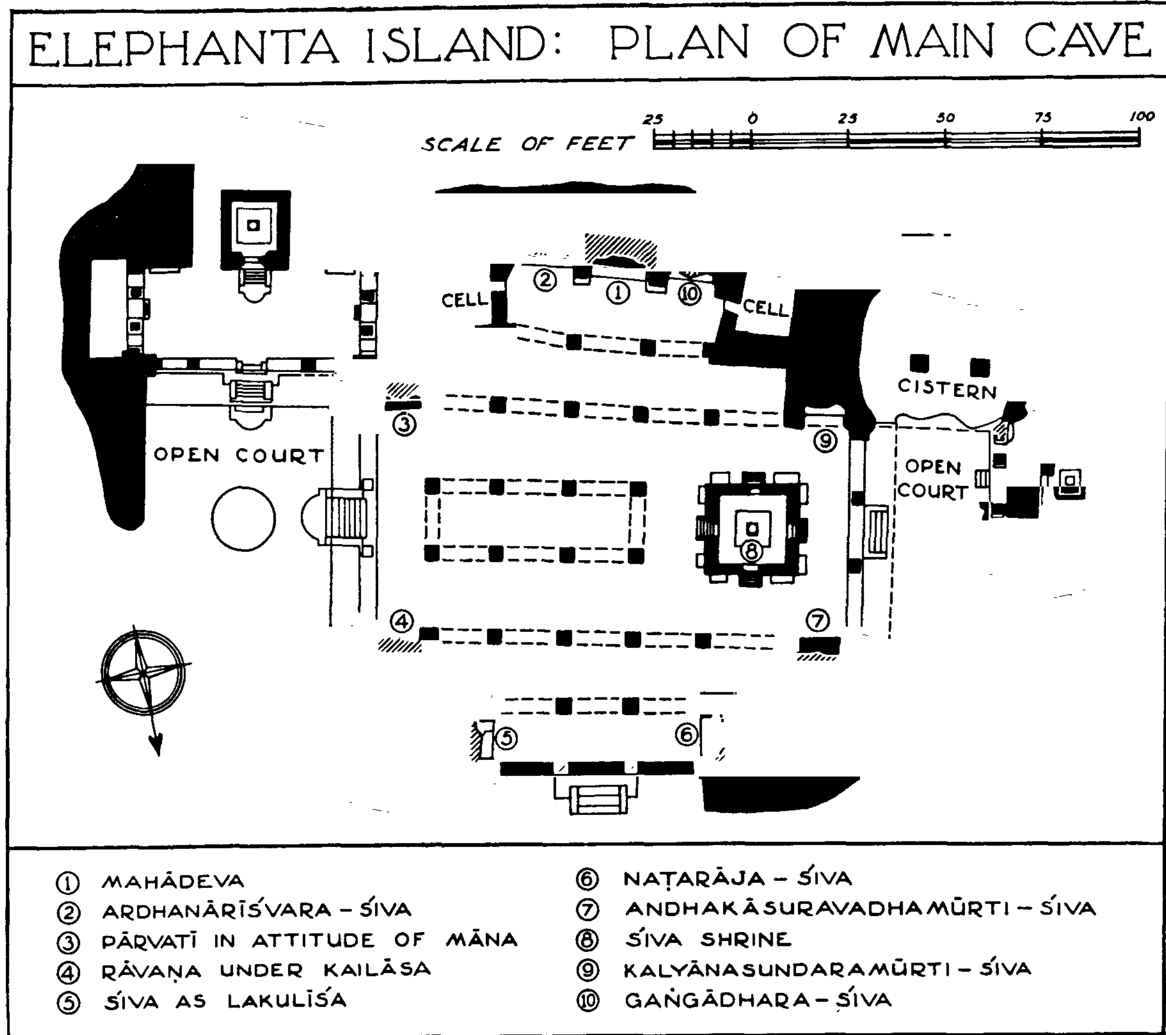


FIG. 1

The three faces are each steeped in its own mood, a closed world, each silent, unseeing, each turned away from the other, but each blossoming in generous curves round the stem whence they originate and derive their stability. They are carved in widely sweeping surfaces which bind the crowned triune head in depth just as the triple 'arch' binds it vertically. Hands and flowers, serpent, hair and jewels are laid against the smoothness of face and body. Each face has its own physiognomy, each crown correspondingly its own ornaments, the hands their respective symbols; but they are upheld and comprised by the power and unity of the total image.

The *Vishṇudharmottara* speaks of the five faces of Śiva (*Śambhor=vadana-pañchakam*). They are Īśāna, Tatpurusha, Aghora, Vāmadeva, Sadyojāta.[1] They face the four directions; the first face, the highest, is not carved, as a rule, on those images which are known as *pañcha-mukha-liṅga*, the five-faced sign or symbol. *Pañcha-mukha-liṅgas* have four faces, in the four directions, they are carved against the central *liṅga* pillar whose rounded top surmounts them.[2] Although four faces only are generally carved, they too need not all be visible; three, two or one face only is required to be shown if the innermost sanctuary in which stands the *liṅga* has four, three, two or one door respectively.[3]

The names of the five faces are those of the five *mantras*, Sadyojāta, etc.[4] *Mantras* are rhythmical formulae; they evoke a supernatural presence, each *mantra* conjures up a corresponding vision of that supernatural presence. The rhythmic spell compels and constitutes its 'body'. Thus it is said of Śiva, the Supreme Spirit (*Paramātman*), that his body is *mantra* (*vidyā*).[5] It is made visible in the shape of a sign (*liṅga*). The *liṅga* is composed of *mantras* and is to be regarded as the body of Śiva, the place where he is present. Four of these *mantras* occupy the four regions of the manifested world and the fifth, Īśāna, lies beyond them, in the central direction. From there, it is at the same time everywhere, a subtle luminous presence. It condenses into a celestial light (*divya-liṅga*) equivalent to the vibrations released by the recitation of the respective *mantras*. The *divya-liṅga*, which is Tatpurusha, forms the central 'root pillar' (*mūla-stambha*) of celestial light; Vāmadeva however is the *liṅga*, installed and consecrated on its base.[6] In the 'root pillar' everything has its origin and finally ends in it. Thus, it is said, it was called the *liṅga*.[7] By the evocative power of the *mantras*, Śiva is realized throughout the universe; the universe is His body (*śarīra*)[8]; this body is of pure Energy (*śāktika śarīra*), containing all the elements, itself the primordial substance (*pradhāna*) of the moving universe.

The 'body' of Śiva, the sign (*liṅga*) of Him who pervades the universe, faces all directions, is given a face in every direction; the faces are summed up and represented at the cardinal points and in the fifth direction. Each face conveys a particular aspect of Śiva, and its physiognomy indicates its nature. Certain signs also of identification are laid down in the texts; Tatpurusha holds the *mātuluṅga* or *bījapūraka*, a citron, in one hand, and a rosary (*akshamālā*) in the other.[9] The *bījapūraka* is full of the atoms of the seeds of this

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[1] Īśāna is the first 'form' in the hierarchy of manifestation of the Supreme Śiva; Tatpurusha is next and is followed by Aghora, Vāmadeva and Sadyojāta; they are thus also likened to the elements of which the universe consists, the first being ether, invisible and everywhere; the others are air, fire, water and earth (*Vishṇu-dharmottara*, III, xlviii, 1–3).

[2] The *pañcha-mukha-liṅga* from the Śiva temple at Nachnā-kuṭhāra is the most perfect of its kind. It was carved in the later Gupta age.

[3] *Rūpamaṇḍana*, IV, 94. T. A. Gopinatha Rao, *Elements of Hindu Iconography* II (Madras, 1914), 97. A *chaturmukha*, etc., *liṅga* may however also be placed in a shrine with one door only.

[4] The five *mantras* are given in the *Taittirīya Āraṇyaka*, X, 43–47.

[5] *Īśānaśiva-gurudeva-paddhati*, III, v, 1.

[6] Cf. G. Rao, op. cit., p. 366.

[7] *Suprabhedāgama*; G. Rao, op. cit.

[8] *Vishṇudharmottara* (referred to as *V. Dh.* below), III, xlviii, 20.

[9] *Īśānaśiva-gurudeva-paddhati* (referred to as *Ī.P.* below), III, xii, 35; *Rūpamaṇḍana*, IV, 12-13. The *dhyāna-ślokas* in the various texts are not identical in detail There are as many, if not necessarily the same, variations there as in the images. The vision held by signs and words is the same: different ages and different schools see it under particular modifications. The *Vishṇudharmottara*, III, xlviii, 9, assigns to the face in front (Mahādeva) the rosary and the water-vessel (*kamaṇḍalu*) instead of the citron (*mātuluṅga* or *bījapūraka*).



The Mahādeva of Elephanta Island

To face Plate III



The Mahādeva of Elephanta Island, with dvārapālas



The Mahādeva of Elephanta Island
(Scale of feet)



The Mahādeva of Elephanta Island



The Mahādeva of Elephanta Island: Tatpurusha
(Scale of feet)

To face Plate VII



The Mahādeva of Elephanta Island: Aghora, the wrathful



The Mahādeva of Elephanta Island: Vāmadeva, the blissful
(Scale of feet)

universe[1]; the rosary is a symbol of the re-integration of this world.[2] In his crown of matted locks Tatpurusha wears the crescent of the moon; it is its sixteenth digit (*amā-kalā*), symbol of perfectedness and the power of the Lord (*aiśvarya*).[3] Aghora is fierce, terrific, like Time (*Kāla*) itself; serpent and skull belong to him[4]. Vāmadeva is handsome; he is 'woman's delight'.[5]

The *Vishṇudharmottara*, moreover, knows the five faces of Śiva under a double set of names. The first series, Iśāna, Tatpurusha, Aghora, Vāmadeva and Sadyojāta, belongs to the Supreme Śiva in his mental 'body of *mantras*'; they are the faces of the five-faced *liṅga*.

The second set of names is: Sadāśiva, Mahādeva, Bhairava, Umā and Nandin.[6] Thus the face in the middle is that of Tatpurusha-Mahādeva; Aghora-Bhairava is on the one side and Vāmadeva or Umā on the other. The latter face, which is that of the Beauteous God (Vāmadeva), is also that of the Goddess Umā, who is Śiva's *Śakti*, inseparably part of his nature.

The second set of names denotes the faces of the Supreme Śiva, fully manifest; he is the 'Great Lord', Maheśa.[7]

Thus was carved the image of Mahādeva in Elephanta. It is symbol and image, *liṅga* and *mūrti*, in one; the concrete form of the Supreme Śiva, fully manifest. Around this image, in separate panels, are carved his *līlā-mūrtis*, the various forms and actions in which is displayed his divinity. But the image of Mahādeva dominates the whole assemblage. It is the concrete form of Śiva whose *liṅga* is worshipped in the adjacent shrine. The plan of the rock-cut temple—and not only the disposition of the *līlā-mūrtis*—was thus adjusted to the image, the entire hall is laid out in front of it in its deep recess. The stage is set for that form (*rūpa*) of His who is beyond form, and who pervades the universe, which thus is His visible body.

The central pillar, the *mūlastambha*, rises with the face of Tatpurusha. His matted hair forms his cylindrical crown. It is clasped by a diadem of wide curves, clear cut. The serpentine locks, the splendour of the jewel crests which has its symbol in the leonine Face of Glory (*kīrttimukha*) in front, the crescent moon on its right, the tender, folded *aśoka* leaves of early spring, and their full flower-cups—all this precious, delicately carved, intimately agitated coiffure, full of meaning, closely adheres to the shape of the central pillar and none of its subtle detail is allowed to caress the august serenity of the face. The rim of the diadem with its wide curves tightly fits its planes; no curl transgresses, nothing disturbs its silence. The long curves of the ears are set against locks, a closely woven crop that frames each of the lateral faces; capricious, viciously encircled, tumescent, serpentine on Aghora-Bhairava's face, with drooping elegance they touch the cheek of the face on the right. Within their symmetry, each of these two crowns is truly a part of the nature of that god whose face bears his name and whose hands hold his insignia. Obstinate and coagulate, skull-adorned, the crown of Aghora-Bhairava ascends, then slopes back in a

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1 *V.Dh.*, III, xlviii, 12.

2 *V.Dh.*, III, xlvi. For its resorption by Time (*Kāla*), *Vāchaspatya*, s.v.

3 *V.Dh.*, III, xlviii, 17.

4 *Ī.P.*, III, xii, 36-37; *Rūpamaṇḍana*, IV, 5–12.

5 *Ī.P.*, III, xii, 38, *strīvilāsa*.

6 *V.Dh.*, III, xlviii, 4–6.

7 He is the immanent and primordial cause of the universe and its primordial substance (*prakṛiti*). The *V.Dh.*, III, xlviii, 19, says that Maheśvara is white, as white as *prakṛiti*. The image of Maheśvara (Mahādeva) must originally have been painted white.

steep angle; whereas, above its diadem, the crown of Umā, on the right, is joined in one ripe roundness to the firm pillar of Tatpurusha's crown.

The wrathful aspect of Aghora or Bhairava, his face bulging with the curves of frenzied life, his moustache like lightning flashing across the full lips; small and young, wrapt in its bliss, the face of Umā, yet related by a structure of interlaced curving planes; deeply silent, the triune head holds its mystery, vital and deathly on the left, knowing and blissful on the right, and free of any attribute in the face of the middle. Ponderous yet weightless lips, relaxed in meditation, are the bar, the closed door, whereby the initiate and perfected alone may pass, and enter the state of Śiva.

THE MEGALITHIC BURIALS AND URN-FIELDS OF SOUTH INDIA IN THE LIGHT OF TAMIL LITERATURE AND TRADITION[1]

By K. R. SRINIVASAN

Reference has been made above (p. 1) to the current survey of the megalithic monuments of South India, and of the urn-fields which appear to be in part contemporary with them. These memorials of 'non-Aryan' India (as it would appear) are of more than local interest. In other parts of Asia, in Africa and in Europe are megalithic structures closely similar to some of those of the Indian peninsula, and the possibility of an integral unity of ideas and expression over a large part of the earth's surface from 2,000 to 4,000 years ago lends to the enquiry an unusual potential importance. At present, however, we know very little about the Indian monuments of this class, and, pending the results of fieldwork, information from any source, however indeterminate, is worthy of consideration. An Assistant Superintendent in the Archaeological Survey of India who was formerly Curator of the Museum of Pudukkottai State, where megaliths are particularly numerous, here draws certain general conclusions from the evidence of Tamil literature and tradition.

THOUGH an extensive literature has grown up about the numerous megalithic burials in India, we are as yet nowhere near an accurate knowledge of their date or of the various cultural phases which they seem to represent. Their correct interpretation still awaits the spade of the scientific archaeologist. Meanwhile it is useful to know something of the local traditions about them, and of the references to them in the literature and inscriptions of the Tamil country where they occur in such profusion,[2] and where a rich heritage of literature is extant, ranking in antiquity next only to Sanskrit. In the present paper are collected a number of references—traditional, literary and epigraphical—which are difficult of access to scholars not acquainted with the Tamil language and literature.

Tradition and epigraphy

Megalithic sites are locally called *kuraṅguppaṭṭaḍai*, which has sometimes been taken to mean 'the workshop of the monkeys' and associated with a legend relating to the monkey hordes that followed Rāma. A Pāṇḍya inscription of the thirteenth century from Nārttāmalai,[3] relating to the endowment to the temple of lands in Tāyinippaṭṭi, on the other side of the hills, describes an area included within the boundaries—a burial site—as 'strewn with large stones and containing *kurakkuppaḍai*'. Thus the modern name *kuraṅguppaṭṭaḍai* is a corruption of the old name *kurakkuppaḍai* or *kurakkuppaṭṭaḍai* which means 'a sepulture or tomb lowered into the earth'. This can only refer to the stone cists.[4] The name *kalkuttu* sometimes given in old revenue registers to these sites

[1] Part of a paper entitled 'Indian Megaliths, with special reference to Pudukkottai' read before the Anthropology and Archaeology Section of the 31st Indian Science Congress, Delhi, 1944.

[2] The results of the author's survey of these sites in Pudukkottai State alone (1,178 sq. miles) have shown that there are more than 80 villages containing more than 150 groups of these ancient burials in all their variety. There are at least as many in each of the other districts of the peninsula awaiting systematic survey.

[3] *Inscriptions (Texts) of the Pudukkottai State* (State Press, Pudukkottai, 1929), No. 325, p. 197.

[4] *Kurakku* means 'to lower or bury'; *paḍai* may mean a bed on which one rests, the original connotation of the Sanskrit word *smaśāna* which according to Yāska is a 'couch of stone' (*aśma-śayana*). *Paḍai* is

is clear, meaning places where stones are planted or pitched. Since the sites contain pottery urns, they are also described by the local people as places with *madamadakkattāḻi*, which is a corruption of *mudumakkaḷ-tāḻi*, meaning the urns or receptacles (*tāḻi*) in which the ancients or ancestors are buried. This is the name found in early Tamil works from the third century B.C. to the twelfth century A.D. The other synonyms found in these are *mudu-makkat-cāḍi* (*cāḍi* or *jāḍi*-jar), *īmattāḻi* (funerary urn or receptacle) or simply *tāḻi*. The name *tāḻi* itself, indicating a large receptacle for burial, is evidently derived from *tāḻ* which means 'to lower into the earth' or 'to bury', and the original sense in which it is used is of a vessel that is buried. An early inscription from Tirukkaṭṭaḷai, near Kalaśakkāḍu where these urns are in plenty, denotes a certain land as *andarat-tāḻi-puñcey* [1]—dry land with buried funerary urns. The stone circles are called *kaṟkiḍai* (*kiḍai*, circle, of *kal*, stone) in a Tanjore inscription [2] which mentions them along with the burning-grounds of the Veḷḷāḷar and Paṟaiyar in the village, and this is noticed by Mr. K. V. Subrahmanya Aiyar.[3] The oldest extant Tamil work, *Tolkāppiyam* (Por. 60), has *naḍukal*—the stone planted over the grave, the 'menhir'. The name *pāṇḍavakkuḻi* prevalent in some other Tamil districts may be a corruption of *māṇḍavar-kuḻi*—the burial-pit of the dead, or of *bhāṇḍakkuḻi*—the pit in which the pots (*bhāṇḍa*, in Tamil *pāṇḍam*) are buried. Or it may be a corruption of *pāḻndavakkuḻi*—the burial of those who performed useless penance, as one of the beliefs in later times was that the Ājīvakas or Jainas, whose penance was 'useless' in the eyes of the followers of the Vedic religion, were buried in such pots. The Toda name *āḻāram* means in Tamil the burial circle (*āḻ-āram*). The Kannada name *mōrriar-mane* is difficult to explain. Sewell [4] notices the Telugu names *Rākshasa gullu* or *gōli*—the graves of the *Rākshasas* and derives the name of Gōli village from this.

Before we proceed to examine the literary references, it is of interest to mention a few facts about the word *taḷi* [5] of the early Tamil inscriptions. In the inscriptions of the early period, ranging from the seventh to eleventh century, when the Pallavas and Cōḷas ruled the Tamil country and excavated and built stone temples, the term *taḷi* always denotes the *sanctum* of the stone temples.[6] Prior to this we have literary and inscriptional evidences to show that temples were built of brick, mortar and timber, which perished. The natural caverns in the hills, with drip-ledges, beds and inscriptions, are the earliest monuments extant. These religious resorts were not called *taḷi* but *pāḻi* or *amaṇ-pāḻi* (Jaina cave resorts) since they were mostly associated with the Jaina ascetics. An early inscription (ninth century A.D.) referring to the excavation of a rock-cut shrine, which is called *taḷi*, is published in *Inscr. of Pudukkottai State*, No. 18. The chief, who excavated this Śiva cave temple, says that 'having excavated the Tiruvālattūr hill *in the form of a taḷi*, he installed the god in it'. The expression 'in the form of a taḷi' is significant. It evidently

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probably a derivation from *paḍu*, to sleep or die. In early Tamil inscriptions of the ninth to tenth centuries the word is used in the same sense in *paḷḷippaḍaī*, by which name shrines built over the graves of the Cōḷa kings are referred to. *Paḍai* also means the whole or part of the structure or edifice buried or overground, *paṭṭaḍai* is used in the sense *paḍu*, lay to rest, or *paṭṭu*, to die, and *aḍai* (*aḍakkam* or *aḍakkudal*), burial.

[1] Ibid., No. 38, p. 18.

[2] *South Indian Inscriptions, Archaeological Survey of India*, II (1891) Part 1, No. 5, p. 54.

[3] K. V. S. Aiyar, *Historical Sketches of the Ancient Dekkhan* (1917), p. 359.

[4] R. Sewell, *List of Antiquarian Remains in the Presidency of Madras* (Madras, 1882), I, Topographical List, 57-58 and 60.

[5] See my paper 'A note on Taḷi', *Archaeological Society of S. India*, Madras, July 1944.

[6] *Mēṟṟaḷi* = western temple; *kiḻ-taḷi* = eastern temple; *vaḍa-taḷi* = northern temple; *kaṟṟaḷi* (*kal-taḷi*) = a temple built of stones, etc.

denotes that the structure, a cell, was fashioned in the form of a pre-existing type called *taḷi* or a rock-excavation. This does not occur in Śaṅgam Tamil. In our quest of the origin of this term, our attention is naturally drawn to the rock-cut tombs of Malabar, which happen to be the only rock-cut monuments prior to these early cave temples in the South. The most famous among them is in Taḷi-paṛamba, which is the Malayalam equivalent of the Tamil term *taḷi-paṛambu*, and means in both cases 'the hill containing *taḷi* or rock-cut cells'. Thus we seem to get here what the term *taḷi* originally meant, and the force of the expression 'in the form of a *taḷi*' in the inscription quoted above becomes clear. Incidentally we have got here the local Tamil or pre-Tamil name for this type of funerary monument, which is peculiar to the softer laterite hills of the west coast.

Early literature

The earliest extant works are of the 'Śaṅgam epoch', which was the Augustan age of Tamil literature. They are mainly collections of anthologies of different poets, and the two epics, *Maṇimēkhalai* and *Śilappadikāram*, are said to belong to the close of the period, or to a period slightly later. The poems of the Śaṅgam age are realistic and *prima facie* trustworthy; they portray a civilization with advanced customs and manners, and relate anecdotes of the kings, their wars and their patronage of literary men. The most widely accepted date for this literature is the first three centuries of the Christian era, though some of the works or the literary tradition embodied in them may well go back to a century or two before Christ. The sheet-anchor for this chronology is the synchronism of the *Śaṅgam* Cēra king Śenguṭṭuvan with Gajabāhu I of Ceylon, who according to the *Mahāvamśa* ruled between 113 and 135 A.D. or 173 and 195 A.D.[1]

There is perfect concord between the data relating to the Tamil kings and the life of the Tamils as depicted in the *Śaṅgam* anthologies on one side and the writings of the classical authors of the early centuries of the Christian era (notably the compiler of the *Periplus* and Ptolemy) and the finds of Roman coins of the early Imperial period on the other. The earliest stratum of Tamil literature shows the influence of the growing religions of the North, and the date of this active penetration of Brāhmaṇical, Buddhist and Jaina religions into the South may well be placed in the last three centuries before Christ. We have Jaina caverns of this date in the Tamil country, literary and other evidences of Buddhistic migration to the South and Ceylon, and notices of South India and her trade in the *Arthaśāstra* of Kauṭilya and the *Indika* of Megasthenes. Thus we may take it that what the *Śaṅgam* literature portrays is the culture which existed in the extreme South between the third century B.C. and the third century A.D.

The *Puṛanānūṛu*, an anthology of 400 verses by different poets composed in different periods of the early *Śaṅgam* age, has many references to the burial-ground and to urn-burials and a few to cremation. The general term used for the grave is *kāḍu* or *puṛaṅgāḍu* which means a waste-land set apart for burial in the wilds near the village. It is also called *mudukāḍu* or *mūdūr* which means the place for the ancients or old men after death.[2]

The term *mudukāḍu* has persisted in later works such as the *Tēvāram* (7731) and *Nalvaḷi* and a Pudukkōṭṭai inscription, dated 1237 A.D.[3], refers to the ancestors of the signatories as *mudukkaḷ*.

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1 See K. A. N. Sastri, *The Cōḷas*, I, 68–70; *The Pāṇḍyan Kingdom*, pp. 16–24; and V. R. R. Dikshitar, *Studies in Tamil Lit. and History*, pp. 73-74.

2 *Puṛam*, verses 228, 256; *Maṇimēkhalai*, VII, line 63; *Puṛam*, verse 356.

3 Op. cit., No. 317.

It is only later that one finds the two differentiating names *iḍukāḍu*, 'burial-ground', and *śuḍukāḍu*, 'cremation-ground'. In some places the term *īmam* or *īmakkāḍu* is also used, where *īmam* refers to funeral rituals. Later commentators on Tamil works invariably explain all these terms as the 'burning-ground'. They were influenced by contemporary practices, whereas many of the contexts clearly show that *iḍukāḍu* alone is meant. The *puṟam* gives word-pictures of the grave-yard in many contexts,[1] and all these verses may be summarized as follows:—

'The grave-yard (*kāḍu*), the place of the ancients, on the outskirts of the town or on the skirts of the hilly ground, an expanse of brackish or alkaline soil overgrown with the tree-spurge (*Euphorbia antiquorum* or *kaḷḷi*) and other xerophytes and many thorny shrubs, full of buried urns, where, even during daytime, the owl from its hole in the old tree hoots, where the 'red-eared' cock and the *poguval* bird sit without fear on the conical heap (of stones) above the lids inverted over the burial-urns, where the vulture descends on its many foot-paths which cross each other and the strong-billed crow flies as it likes, where the carrion-eating jackals abound, and the hordes of demons, with their teeth defiled by carrion, grasp the carcases of the dead and eat the white flesh till their mouths reek of the odour, and where lie strewn fragments of white bones and numerous stones concealed by the overgrowth of jungle.'

As regards the actual methods of the disposal of the dead there are many references to burial and some to cremation. The epic *Maṇimēkhalai*, which belongs to the last period of the *Śaṅgam* epoch, summarizes the customs, contemporary and traditional, as follows:

Śuḍuvōr-iḍuvōr-toḍu kuḻippaḍuppōr
Tāḻvayinaḍaippōr-tāḻiyiṟkavippōr. (Ch. 6, 11, 66-67.)

The context of these lines is the description of the great grave-yard of the famous Cōḷa capital, Puhār or Kāvirippūmpaṭṭinam. It was a cosmopolitan city in the early centuries of the Christian era, when in the Tamil country the Vedic, Jaina, Buddhist and other cults had more or less taken root. These two lines enumerate the different sets of people who came there for disposing of the dead, *viz.* those who cremated (*śuduvor*), those who cast away or exposed the dead to the elements or animals (*iḍuvōr*), those who laid the body in pits which they dug into the ground (*toḍu-kuḻi-paḍuppōr*), those who interred the dead body in subterranean cellars or vaults (*tāḻ-vayin-aḍaippōr*), and those who placed the body inside a burial-urn and inverted a lid over it (*tāḻiyiṟ-kavippōr*). The first two methods hardly need any explanation. The third method refers to inhumation; the fourth refers to vaults or cellars (*vayin*) let into the ground (*tāḻ*), i.e. stone cists and the like, in which the body or the remains of cremation are interred; and the last method, which is brief and descriptive, refers to the placing of the body (or the remains of cremation) into burial urns (*tāḻi*), the mouth of which was covered by inverting a lid (*kavi*). This is actually what one finds in the case of urn-burials, which represent by far the most dominant custom as described in the earlier *Śaṅgam* works—the *Naṟṟiṇai*, *Padiṟṟuppattu* and *Puṟanānūṟu*.

The poet Paraṇar describes the mental condition of a distracted mother whose daughter has run away with her lover. The mother prefers death to a life exposed to the scandal of the neighbours and apostrophizes the God of Death as follows:

Māyirum-tāḻi-kavippa-t
Tāviṉṟu-kaḻika-veṟ-koḷḷā-k-kūṟṟē. (*Naṟṟiṇai*, 271, lines 11-12.)

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[1] *Puṟam* 225, lines 7-8; 238, lines 1–5; 240, lines 7–9; 244, line 3; 237, line 13; 356, lines 1–4; 359, lines 1–8; 360, lines 15-16; 362, lines 12–21; 363, line 10; 364, lines 10–13.

'Oh powerless Lord of Death, that cannot take away my life so that my body may be entombed and covered in a big dark urn . . .'

The *Padirṟuppattu* collection has a verse which describes in one context that the grave-yard (*kāḍu*), 'where lay the burial-urn (*tāḻi*) that entombed the king, was the vast expanse below the *vanni* (*Prosopis spicigera*) tree'.

Mannar-maṟaitta tāḻi
Vanni-manṟattu-viḷaṅgiya-kāḍē. (*Padiṟ*, 44, lines 22-23.)

This shows both the custom of urn-burial and the manner in which the royal funerals were performed in those times.

On the death of the Cōḷa king Kiḷḷi Vaḷavan, who died in Kuḷamuṟṟam, the poet Aiyūr Muḍavanār addresses the potter who has to make the urn for his burial and pities his plight as follows:

Kalañjey-kōvē-kalañjey-kōvē

* * * * *

Koḍi-nuḍaṅgu-yānai-neḍu-mā-vaḷavan
Dēvar-ulakam-eydinan-ādalin
Annōr-kavikkum-kaṇṇakanṟa-tāḻi
Vanaidal-veṭṭanaiyāyin-enaiyadū-ūm
Irunilam-tikiriyā-p-perumalai
Maṇṇāka-vanaidal-ollumo-ninakkē. (*Puṟam*, 228, lines 1–15.)

'Oh potter who makest pots for the burial-ground, sending up such a volume of smoke from your kiln that it rises up as a great cloud, gathering as if all the darkness of the world had concentrated in one spot—Oh potter! I wonder what you will do now. Your plight is pitiable. The great scion of the line of the Śembiyar (Cōḷas), whose armies are distributed over the wide expanse of the earth, who is praised by the learned and is comparable to the Sun with his far-reaching rays, that great and powerful Vaḷavan (Cōḷa king) whose elephants carry his unfurled banner waving in the air, has reached the world of gods. You need make a large, wide-mouthed urn for entombing such an exalted monarch. Could you do less than use the great earth as your wheel and the great mountain as the clod of clay ?'

Peruñcāttanār, another poet, feels that he should not survive his patron Veḷimān, and sings:

Kavi-śen-tāḻī-k-kuvi-puṟattirunda

* * * * *

Kāḍu-munninanē. (*Puṟam*, 238, lines 1–5.)

'He has reached the burial-ground where the 'red-eared' cock and the *poguval* sit on the heap (of stones) outside the lid that covered the red burial urn, the strong-billed crow in company with the owl revels with the female of the species of demons', etc.

Another anonymous verse is that of a bereaved wife appealing to the potter who makes the burial-urns and pottery[1] : 'Oh potter that makest the pots, Oh potter that makest the pottery for the burial-ground! Pity my plight and show kindness to her who, like a little white lizard clinging to the spokes of the wheel that turns beside the axle-pin of a chariot, has in his (the husband's) company traversed for long the narrow and difficult paths (of life), and condescend to make the burial-urn large enough to include her too.'

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[1] *Puṟam*, 256, lines 1–7.

Again another poet, Kūkaikkōḻiyār, sings of the 'great burial-ground (*kāḍu*) that is full of buried urns, where the owl and the wild-fowl hoot and the crow caws without pause from their holes in the old tree entwined by bind-weeds, the numerous roots of which have begun to shake'.

Nilambaka-vīḻnda-valaṅgaṟ-pal-vēr
Mudu-mara-p-pondiṟ-kadumena-viyambum
Kūkai-k-kōḻiyanā-t
Tāḻiya-peruṅgāḍu-eydiya-ñanṟē. (*Puṟam*, 364, lines 10–14.)

There are references to cremation in the *Puṟanānūṟu* and the following are examples:—Verse 231 (lines 1–4) by Auvaiyār on the death of the chief Nedumānañji; verse 240 (lines 7–10) by Kuṭṭuvan Kīranār on the death of the *Vēḷ* chief, Āy; verse 244 (lines 1–7) by the Cēra king, Cēramān Mākkōdai, who later died in Kōṭṭambalam, on the death of his queen; verse 246 by the queen of Bhūta Pāṇḍiyan on the occasion of her *satī* on the death of her lord; and verse 363 which says, 'more numerous than the sands on the sea-shore are the kings who ruled this vast earth girt by the great sea, who went away as the lords of the burning-ground without possessing even as much as a *udai* leaf (example of littleness)', etc.

Pēreyin Muruvalār in his verse in praise of the Pāṇḍyan king, Nambi Neḍuñjeḻiyan, refers also to the different kinds of funerals, though not so clearly as in the *Maṇimēkhalai* quoted above.

Iḍuka-venṟō-suḍukavenṟō
Paḍu-kuḻi-p-paḍuka (*Puṟam*, 239, lines 20-21),

where *iḍuka* refers to exposure and burial, *śuḍuka* to cremation and *paḍukuḻi-p-paḍuka*[1] to inhumation.

Chapter 6 of the *Maṇimēkhalai* has a lengthy description of the cemetery called *Cakravāḷakkōṭṭam* in Puhār, where were many monumental shrines built of burnt bricks of various sizes, big and small, distributed in long lines over the burials of saints, kings, or wives who committed *satī* along with their husbands, with indications of their four *varṇas*, *āśramas* and sex, sacrificial pillars on which *balis* were made, and mounds of heaped stones, probably cairns (*niṟai-kal-teṟṟi*). There is also reference to stones in the grave-yard, from which we have already given a quotation above (*Puṟam*, 363, line 19), where the relatives of the deceased are said to be 'more numerous than the stones in the grave-yard'. The *Tolkāppiyam* mentions the *naḍukal* (*Tol. Por*, 60) which is explained as a tall stone planted over a grave or as a memorial in the grave-yard (*paṟandalai*) and was probably the precursor of many of the *vīrakkal* or hero-stones and *mā-sati-k-kal* or the stones over the graves of *satīs* or the memorials to the *paṭṭavar*. The *Puṟanānūṟu*, verses 221, 223, 232, 260-261, 263–65, 306, 314, 329 and 335; *Ahanānūṟu*, 131; and *Malaipaḍukaḍām*, 388-9, give more information about *naḍukal.*

Medieval literature

That by the eleventh or twelfth century A.D. the ancient custom of urn-burial had become nothing but a memory is proved by notices in the later literature. The *Takkayākapparaṇi* of the poet Oṭṭakkūttar of the twelfth century A.D., a composition on Dakshas's sacrifice, associates the 'dead bodies' inside burial-urns (*tāḻi*) with the 'dead bodies' in the natural caverns (*pāḻi*) where 'useless penance' was performed—the latter probably meaning the Jainas

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[1] *Paḍukuli* has an alternative reading *paḍuvaḷi* which is preferred by Dr. Swaminatha Aiyar, as it is quoted in *Yāpparuṅgalam*. When compared with what is said in *Maṇimēkhalai*, *paḍukuḷi* is more suggestive.

or Ājīvakas whose system of penance was 'fruitless' in the eyes of the followers of the Vedic religion.

Tāḻiyiṟ-piṉaṅgaḷum-talaippaḍā-verum-tavap
Pāḻiyiṟ-piṉaṅgaḷum-tuḷappeḻap-paḍuttiyē. (Tak. 376.)

In his two other compositions, the *Vikrama-Cōḻan-Ulā* and *Kulōttuṅga-Cōḻan-Ulā*, eulogistic poems on the two contemporary Cōḷa monarchs, he mentions *mudu-makkaḷ-cāḍi*, 'the jar for the ancients'. In his *Ulā* on Vikrama one of the legendary progenitors of the Cōḷa king was Tarāpati, who designed the jar or urn for the ancients when the 'God of Death having become powerless to take any life (at his will) fled and hid himself from view'.

......................*maṟaḻindu-*
Ōḍi-maṟali-yoḷippa-mudumakkaṭ
Cāḍi-vakutta-Tarāpatiyum. (*Vik. Ulā.*, lines 14–16.)

In the other *Ulā* on Kulōttuṅga one of the progenitors, the twelfth in the line from the Sun, is said to be the first to devise the '*mudumakkaṭ-cāḍi*' for the old and feeble.

Kūḻi-talaip-paṇḍu-kō-n-āḷum
Padumakkaḍavuḷ-paḍaip-paḍaiyak-kātta
Mudumakkaṭcāḍi-mudalōn. (*Kul. Ulā.*, lines 22–24.)

The *Śankara-Cōḻan-Ulā*, another composition of the same class, gives a similar idea. The *Tiruveṇkāṭṭupurāṇam* too has a passage where an ancient king is described as one 'who designed several *mudu-makkaṭ-cāḍi* for the grand old men at a golden age, when the God of Death could not take away any life'.

Śitta-makiḻndu-inbamuṟa-śeṅgō-naḍatta-naman
Uttamanām-enrannāḷ-uyir-koḍu-pōkāmaiyināl
Moytta-mudiyōrkku-mudumakkaṭcāḍi-pala
Vaitta-kula-dīpakanē-mannakō-mannakō. (*Tiriveṇ. Satyanal*, 9.)

This accounts for the tradition in later times that very old people, who had lived their 'four-score and twenty' and were decrepit, were placed inside large urns until their death, to avoid discomfort. This accounts also for the quotation of a late commentator, Naccinārkiniyār (*c.* fourteenth century), in his commentary on the earliest extant Tamil work *Tolkappiyam*, attributing to the Ājīvakas the practice of 'entering the *tāḻi* for penance until death'.

Tāḻi-kavippa-t-tavam-ceyvār-maṇṇāka
Vāḻiya-noṟṟana-mālvaraiye.

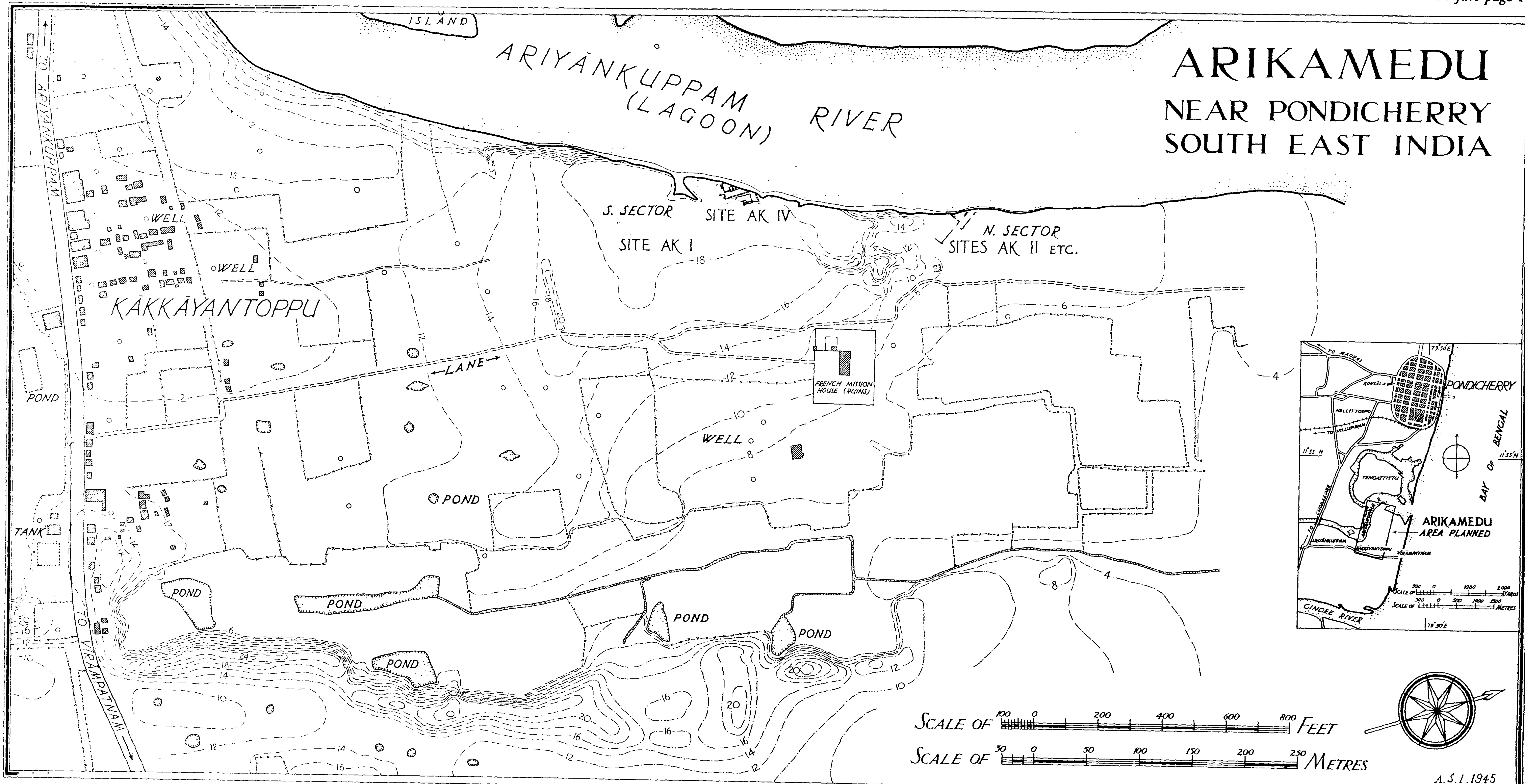
Conclusions

If we accept the postulate that the literature of a people of a particular period not only portrays contemporary life and events but may also embody in it earlier traditions, and that the advanced state of civilization which we find in the *Śaṅgam* period probably had its origin much earlier, we may place the earlier limits of the megalithic and urn-field culture, which seems to have been a dominant factor of early Tamil civilization, in the pre-*Śaṅgam* epoch, i.e. earlier perhaps than the last three centuries B.C. and earlier, too, than effective 'Aryan' contact with South India.

The gradual percolation of 'Aryan' ideas into the Tamil culture is noticeable in the different strata of the *Śaṅgam* literature, and as we approach the close of the period the influence of these ideas gets more and more marked until the two cultures become

thoroughly intermingled; when we hear of the Tamil kings performing and protecting Vedic sacrifices, and find cremation according to Vedic rites taking precedence over the more ancient customs of burial. By about the fifth century A.D. comes a dark chapter in Tamil history, synchronizing with the Kaḷabhra interregnum, and when we see light again in the sixth to seventh centuries A.D. we have a literature totally different from the *Śaṅgam* works in vocabulary, diction and metre, and predominantly devotional in nature. This, taken together with the misconceptions about the burial-urn enumerated above from the literature of the eleventh century and after, indicates the later limit of the megalithic and urn-field burial customs in South India as the beginning of the fifth century A.D. or earlier.

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ARIKAMEDU:

AN INDO-ROMAN TRADING-STATION ON THE EAST COAST OF INDIA

By R. E. M. WHEELER, with contributions by A. GHOSH *and* KRISHNA DEVA

Arikamedu, the special importance of which in South Indian archaeology has been stressed on p. 1 of this Number, represents the site of a considerable buried town on the Coromandel coast. Two sectors (Northern and Southern) excavated in 1945 and partially uncovered by previous excavators were found to have been occupied in the first and second centuries A.D., and to have been extensively despoiled for bricks in the middle ages and later. The Northern Sector contained the remains of a substantial structure upwards of 150 feet long, built about A.D. 50 on the former foreshore above vaguer vestiges of earlier occupation extending perhaps over half a century. The building, from its site and character identified as a warehouse, must from the outset have been liable to flooding, and was abandoned at an early date. The Southern Sector, on the other hand, comprised a site which stood some 10 feet above flood-level, and was occupied for a hundred years or more from the middle of the first century A.D. onwards. Its principal structures consisted of two walled courtyards associated with carefully built tanks supplied and drained by a series of brick culverts. It is conjectured that these tanks and courtyards were used in the preparation of the muslin cloth which has from ancient times been a notable product of this part of India and is recorded by classical writers as an Indian export. Amongst the other industries of the town was that of bead-making. Gold, semi-precious stones and glass were used for this purpose, and two gems, carved with intaglio designs by Graeco-Roman gem-cutters and in one instance untrimmed, suggest the presence of Western craftsmen on the site. Numerous sherds both of a red-glazed pottery known to have been made in Italy in the first centuries B.C.–A.D. and of the two-handled jars or amphorae characteristic of the Mediterranean wine-trade of the period, together with Roman lamps and glassware, combine to indicate that Arikamedu was one of the regular 'Yavana' or Western trading-stations of which both Graeco-Roman and ancient Tamil writers speak. As the first of these stations actually identified by excavation in India, Arikamedu will hold henceforth a distinguished position in the history of the economic relations of India with the outside world. And the discovery has other features of interest. A Roman market on the Coromandel coast implies a knowledge of the south-western monsoon, which the historian may now suppose to have been in regular use at an earlier date than was previously conjectured. The epigraphist and the palaeographer will find amongst the graffiti some of the earliest dated fragments of the Tamil language. To the geographer, the very considerable rise in water-level shown to have occurred hereabouts within the last two thousand years, though due at least in part to local causes, is perhaps of incidental note. But the most significant result of these excavations is that, by establishing at last the precise chronological position of an extensive South Indian culture, the archaeologist has provided a new starting-point for the study of the pre-medieval civilizations of the Indian peninsula.

CONTENTS

1. THE SITE AND ITS HISTORICAL BACKGROUND

THE classical geographers and the Tamil literature of the 'Śaṅgam' age have familiarized historians with the outlines and some of the details of Indian trade with the West in and after the first century A.D. At its prime, the trade was extensive. It included as Indian exports pepper, pearls, gem-stones, muslin, tortoise-shell, ivory and silk; and as imports from the West coral, lead, copper, tin, glass, vases, lamps, wine and, at first, coined money.[1]

By the latter part of the first century A.D. the literary evidence makes it clear that this trade was organized on lines not unlike those of the European 'factories' established in India from the sixteenth century onwards. The *Periplus of the Erythraean Sea* (*c.* A.D.

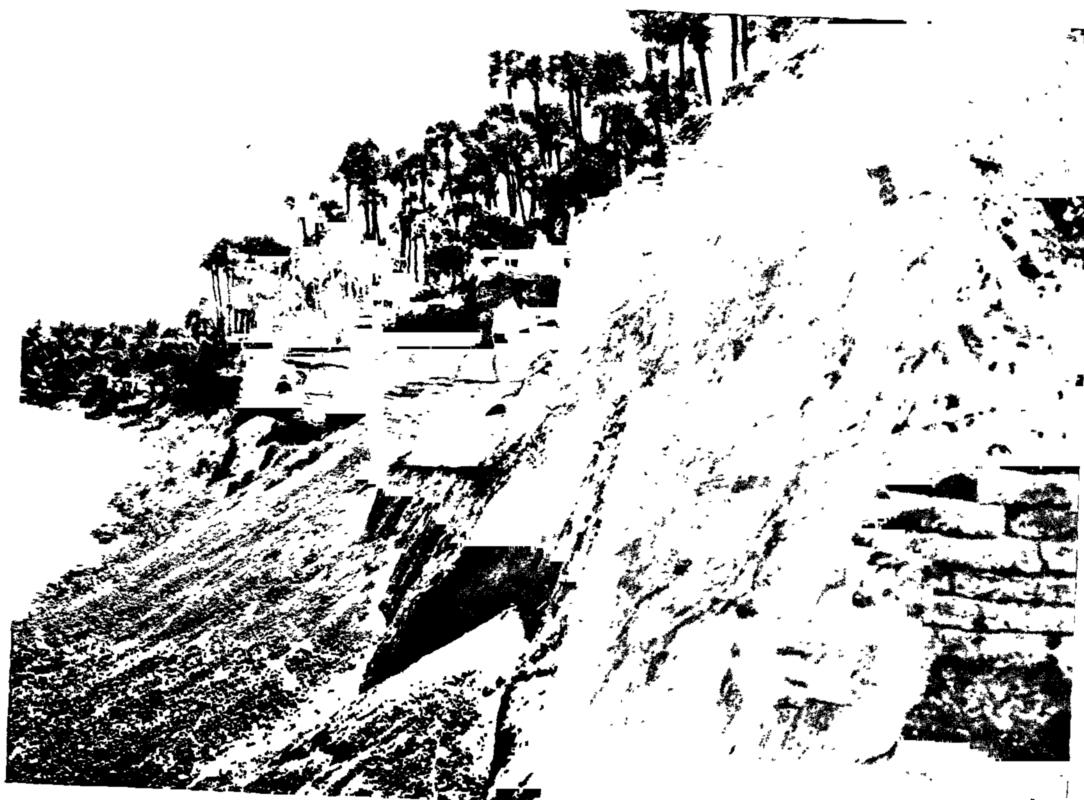
[1] The best reviews of Indian trade with the Roman Empire are by M. P. Charlesworth, *Trade-routes and Commerce of the Roman Empire* (Cambridge, 1926), and E. H. Warmington, *The Commerce between the Roman Empire and India* (Cambridge, 1928). See also H. G. Rawlinson, *Intercourse between India and the Western World* (Cambridge, 1916); K. A. Nilakanta Sastri, *The Cōḷas*, I (University of Madras, 1935); and P. T. Srinivas Iyengar, *History of the Tamils from the earliest times to 600 A.D.* (Madras, 1929).



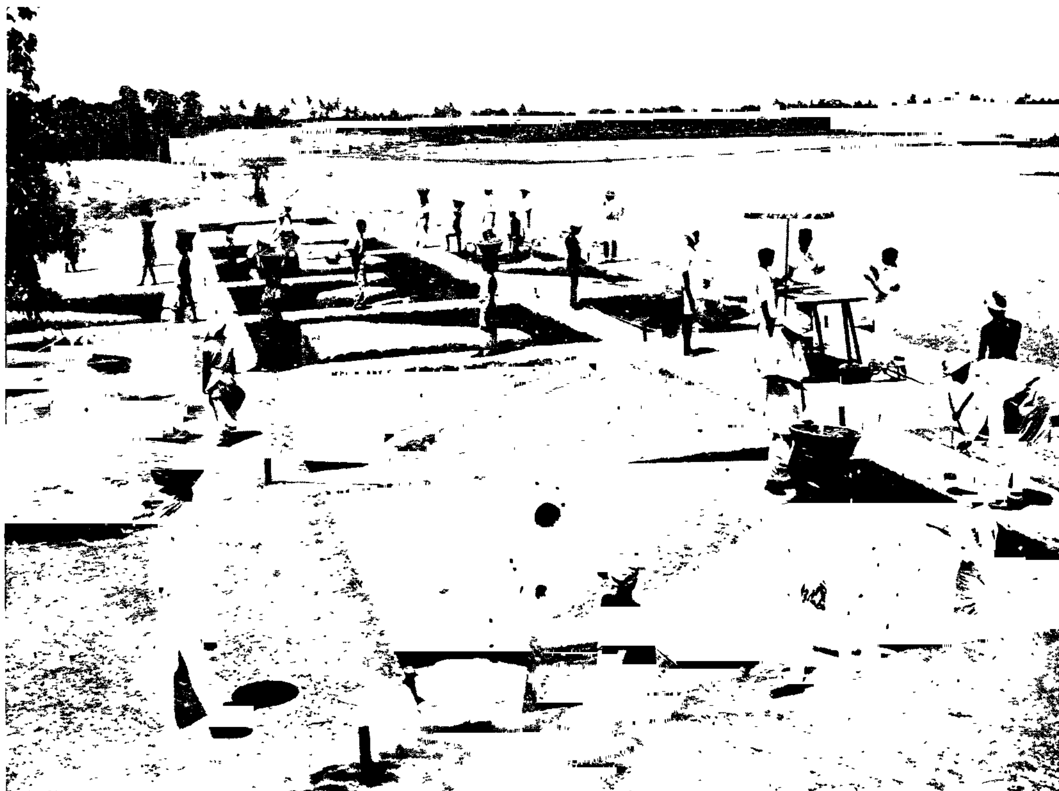
Arikamedu: Northern Sector in middle distance, Southern Sector in background



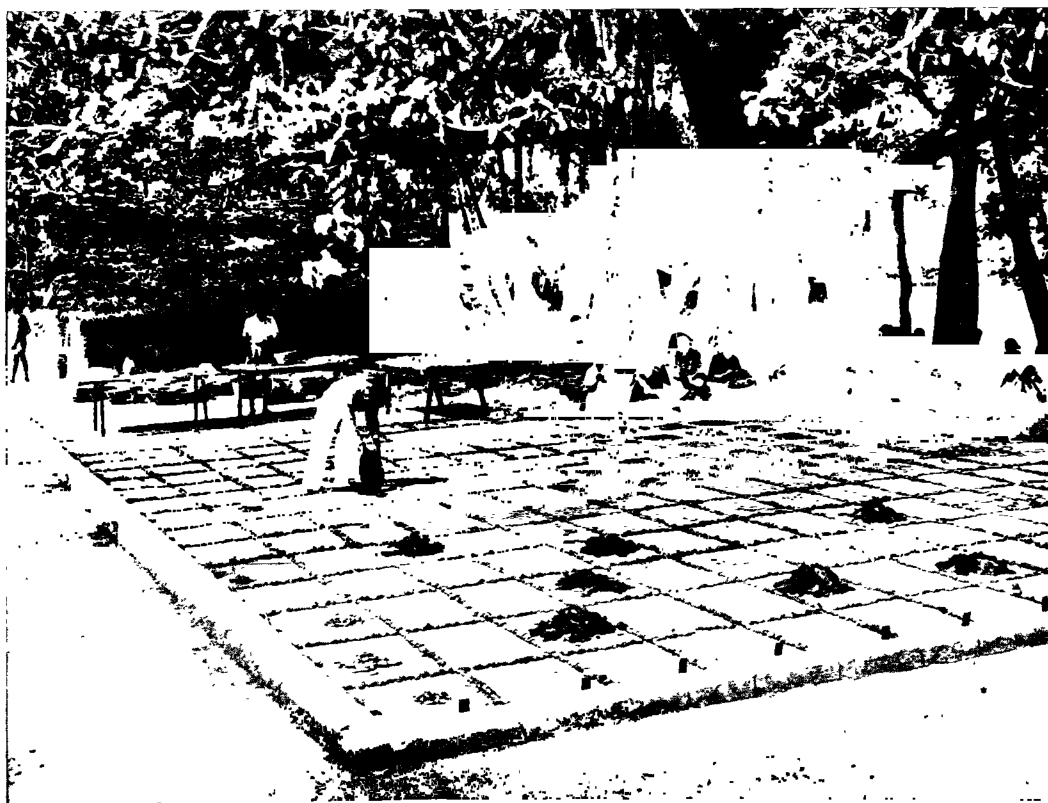
A. *Arikamedu from the west: Southern Sector in right background*



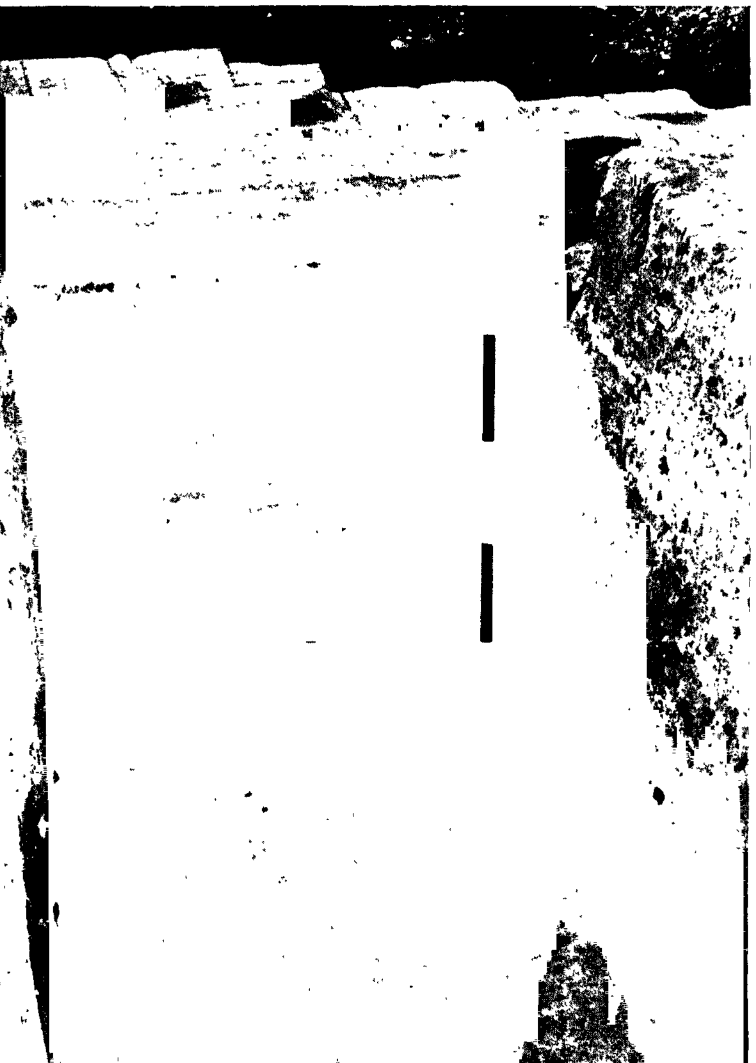
B. *Arikamedu: walls projecting from river bank*



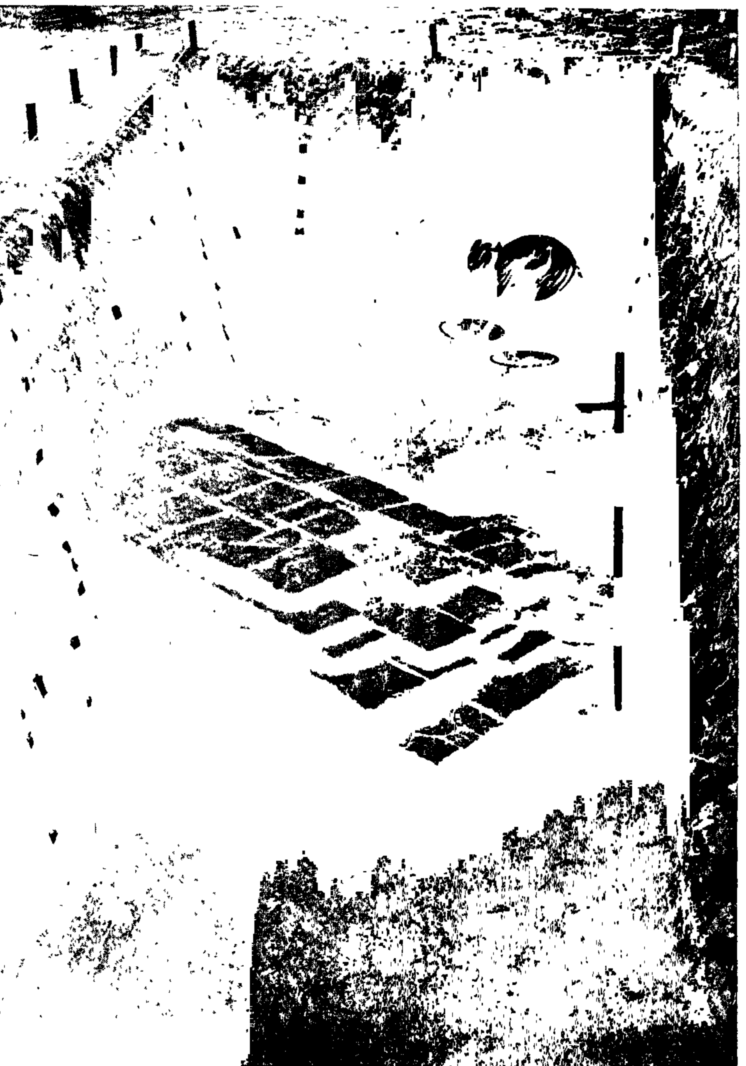
A. *Site AK IV*



B. *Pottery deposited for examination in squares numbered with the horizontal and vertical locations of strata*



A. *Northern Sector : south-eastern wall of 'warehouse' (AK V)*



B. *Northern Sector : north-eastern wall of 'warehouse'*

60–100) speaks of ἐμπόρια νόμιμα, the unqualified ἐμπόρια of Ptolemy (*c.* A.D. 150), which may fairly be described as treaty-ports.[1] That is to say, permanent lodges of Western traders[2] were settled in them under formal agreement with the appropriate Indian ruler, and were visited at the proper seasons by convoys of deep-sea merchantmen. And just as the agents of the Portuguese, Dutch, Danish, French or British establishments in the days of the Companies travelled widely in the interior to circumvent the middlemen, so we may with probability recognize in some of the Roman coin-hoards far from the sea (fig. 48) the penetration of earlier Western traffickers with similar intent.

On the scale indicated, this organized interchange implies a knowledge of the periodicity of the monsoons. Without that knowledge, which, according to Pliny,[3] could restrict the crossing of the Indian Ocean to forty days, the laborious coastal voyage to India or the still more precarious overland routes must have prevented the development of regular and direct trade with southern or eastern India. The establishment of permanent agencies in those parts must therefore have post-dated the discovery of the so-called 'Hippalus' or south-western monsoon; a discovery of unknown date but appreciably earlier than Pliny and the *Periplus*, and possibly, though not certainly, earlier also than *c.* A.D. 21, when Strabo speaks of 120 ships sailing for India from Myos Hormos on the Red Sea.[4] On the other hand, there is no hint that the monsoon was familiar to Mediterranean merchants before the time of the Roman principate. The unification of the western world under Augustus (23 B.C.–A.D. 14) and the recorded reception by him of at least two Indian delegations (*c.* 25 B.C. and 21 B.C.)[5] provide an obvious context, if not for the actual discovery, at least for its diffusion beyond the corporations of Arab sailors and other agents who had jealously monopolized the Indian traffic thitherto.

Further than this the literary evidence fails to carry us. Warmington conjectures from it that the direct route from the Red Sea to the Malabar coast, i.e. the full use of the monsoon, was introduced 'soon after 41'.[6] Archaeology now indicates a rather earlier date. Some considerable time prior to the abandonment of the manufacture of Italian red-glazed pottery (Arretine and related fabrics)—an event which is unlikely to have been later than A.D. 50—a Roman emporium is now known to have been firmly established far up the eastern coast of India, near Pondicherry. We may infer that at least as early as *c.* A.D. 30, and possibly before the death of Augustus, regular monsoon-trade had been established between the Mediterranean and western India, with a coastwise or overland extension to the Coromandel coast. Whether at this early date the route was carried to its logical conclusion in Malaya and China is at present unknown. By the second century, at any rate, Antonine coins would appear to have penetrated to Long Shuyen and the peninsula of Cochin China, where they were dug up by Mr. L. Mallaret in 1945.[7]

Before we turn to the Pondicherry site, the literary picture of these trading-cities may be completed in outline by reference to one or two familiar passages in the Tamil literature. This literature is very insecurely dated, but the relevant passages, which are numerous, may be ascribed on general grounds to the early centuries A.D. It was probably in the second century, for example, that the city of Puhār or Kāvērippaṭṭinam, at the mouth of the Kāverī river 60 miles south of Pondicherry, was thus described in the epic *Śilappadikāram* ('The Lay of the Anklet'): 'The sun shone over the open terraces, over the warehouses near the harbour and over the turrets with windows like the eyes of deer.

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[1] Warmington, p. 107.

[2] At Muziris (Cranganore, Cochin State) the *Peutinger Table,* second to third century A.D., marks a 'temple of Augustus'.

[3] VI, 104. [4] II, V, 12. [5] The Monumentum Ancyranum states that such embassies came 'frequently'.

[6] Op. cit., p. 45. [7] Information from Mr. H. Gervais, of the École Française d'Extrême-Orient.

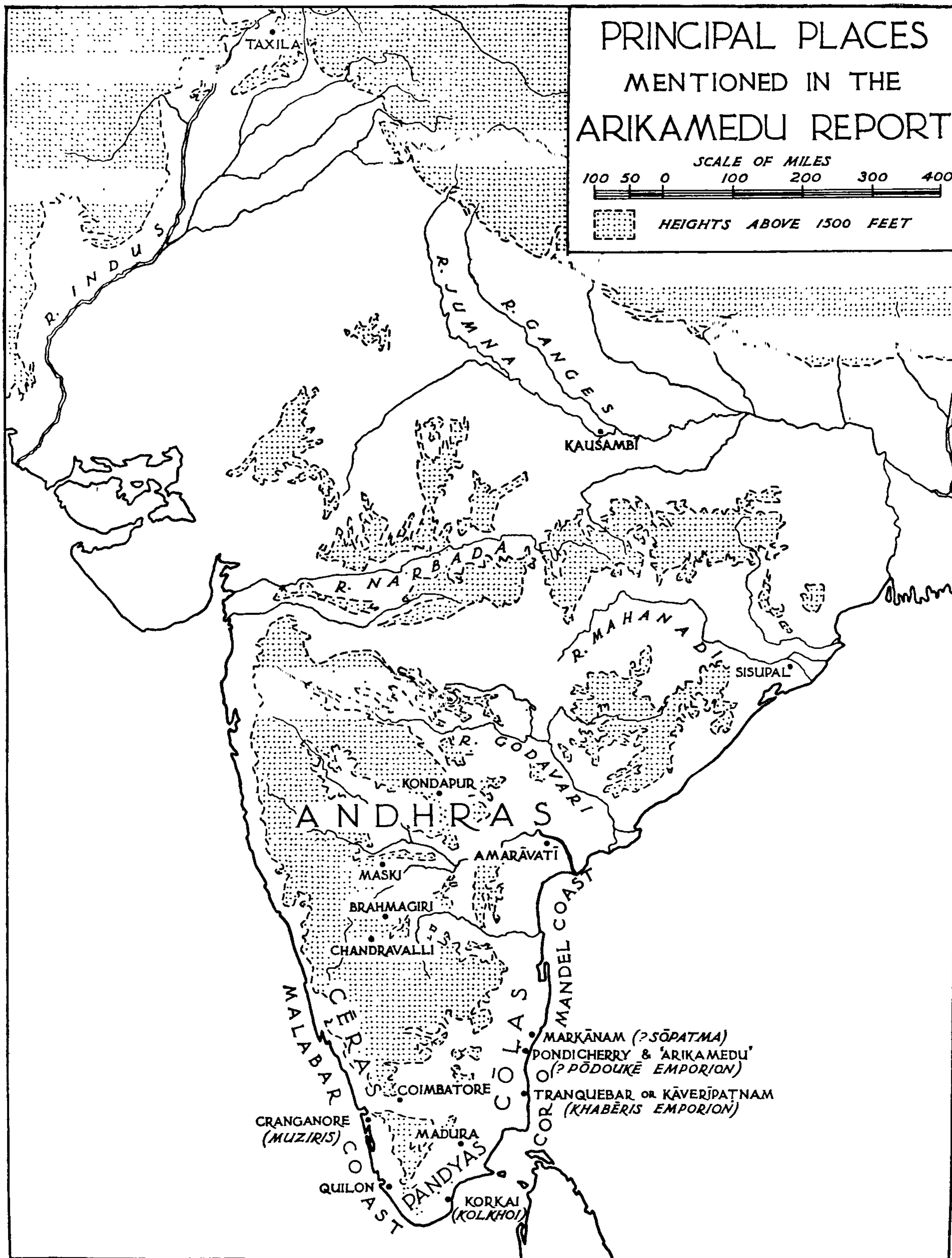

PRINCIPAL PLACES
MENTIONED IN THE
ARIKAMEDU REPORT
SCALE OF MILES
100 50 0 100 200 300 400
HEIGHTS ABOVE 1500 FEET
TAXILA
R. INDUS
R. JUMNA
R. GANGES
KAUŚAMBĪ
R. NARBADA
R. MAHANADI
SISUPAL
R. GODAVARI
KONDAPUR
ANDHRAS
AMARĀVATĪ
MASKI
BRAHMAGIRI
CHANDRAVALLI
MALABAR COAST
CERAS
COLAS
COROMANDEL COAST
MARKĀNAM (? SŌPATMA)
PONDICHERRY & 'ARIKAMEDU'
(? PŌDOUKĒ EMPORION)
COIMBATORE
TRANQUEBAR OR KĀVERĪPATNAM
(KHABĒRIS EMPORION)
CRANGANORE
(MUZIRIS)
MADURA
QUILON
PĀNDYAS
KORKAI
(KOLKHOI)

FIG. 1

In different places of Puhār the onlooker's attention was arrested by the sight of the abodes of Yavanas [men from the Graeco-Roman world] whose prosperity never waned. At the harbour were to be seen sailors from distant lands, but to all appearance they lived as one community . . . . .'.[1] In another poem, a Pāṇḍya prince is exhorted to drink the cool and fragrant wines brought by the Yavanas in their vessels.[2] Again, 'agitating the white foam of the Pēriyāru, the beautifully built ships of the Yavanas came with gold and returned with pepper, and Muziris resounded with the noise'.[3] And Tamil rajas employed bodyguards of western mercenaries, 'the valiant-eyed Yavanas whose bodies were strong and of terrible aspect' and who, equipped with 'murderous swords', were 'excellent guardians of the gates of the fort-walls'.[4] In this capacity they are said to have been employed at Madurā. Yavana craftsmen were also sought after in southern India, especially for the manufacture of siege-engines.[5] In one way and another, the Yavana *in partibus* enjoyed a considerable prestige whether as trader or as settler.

* * * * * * *

Two miles south of the centre of Pondicherry, the capital of French India, a former outlet of the Gingee or Varāhanadī river forms a lagoon locked to-day, save in full flood, by a sand-bar from the Bay of Bengal. The lagoon, known as the 'Ariyānkuppam river' from the name of the largest adjacent village, is fringed by cocoanut-palms which, with a belt of sand-dunes, shelter it mostly from the sea. In the vicinity of the little village of Kākkāyantōppu, the eastern bank of the lagoon stands some 20 feet above the water and from the scarp project the jagged ends of successive brick buildings to which the mound or *mēḍu* owes its being (pl. XB). To the villagers the site is known as Arikamedu, and, though no more formal origin for the name has been discovered, it will serve as well as any other.[6]

Destruction of the buried buildings by the river in flood has been accompanied by extensive destruction from other causes. Tree-planting and, above all, brick-robbing have combined in the work. As far back as 1734 there is record of the latter process,[7] and fragments of Chinese celadon ware of the ninth to twelfth centuries found in 'robber-trenches' throughout the excavated site indicate a similar process as early as the Middle Ages. To-day, the nucleus of the site is protected by the French Government.

In the eighteenth century the visible remains were described by Le Gentil,[8] who incidentally remarks upon their destruction by the river. But archaeological attention was first directed to the site by Mr. G. Jouveau-Dubreuil who, in and after 1937, made a collection of beads and gems found on the surface by the local children. One of the gems is reported to bear a head of Augustus in intaglio, and this induced Mr. Jouveau-Dubreuil to exclaim 'Nous avons là une véritable ville romaine'.[9] In the sequel, excavations were carried out in and after 1941 by Brother L. Faucheux of Pondicherry in collaboration with Mr. R. Surleau, then Chef des Travaux Publics. The excavators ignored stratification

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[1] *The Śilappadikāram*, trans. V. R. Ramachandra Dikshitar (Oxford, 1939), p. 110.

[2] K. Pillai: *The Tamils eighteen hundred years ago*, pp. 12 and 37 ; Iyenger, op. cit., p. 312.

[3] Iyenger, p. 312. [4] Ib., p. 313; and Warmington, p. 80. [5] Iyenger, pp. 313ff.

[6] Mr. K. R. Srinivasan has suggested that the name may be *Arukkumēḍu*, meaning 'mound of ruins' (*arukku*=to destroy or ruin); or it may be *Arukumēḍu*, meaning 'mound on a river bank' (*aruku*, according to old usage still surviving in Pondicherry—see Tamil Lexicon under *Aruku-Kollai* and *Arukadigam*—signifies the neighbourhood or bank of a river).

[7] L. Faucheux, *Une vieille cité indienne* (Pondicherry, 1945), p. 2.

[8] *Voyage dans les mers de l'Inde* (Paris, 1779–81), I, 542–5.

[9] *Bulletin de l'École Française d'Extrême-Orient*, XL (1941), 450. Mr. Jouveau-Dubreuil's collection was sent to the French School museum at Hanoï, Indo-China, and I have not seen the Augustus gem.

and no accurate plan was prepared, but the work had the primary merit of proving in bulk the real importance of the site and of revealing the presence of pottery from the Mediterranean. An untrimmed intaglio representing Cupid and an eagle, of classical workmanship, was also found (pl. XXXIIIB, 11).

On a visit to Pondicherry in 1944 I observed several sherds of Italian red-glazed ware (the so-called Arretine) amongst the proceeds of the excavations exhibited in the town library.[1] Since this ware can be dated with some precision, it was evident to me that here we had for the first time what had long been sought in vain, namely, a firm datum-line in pre-medieval South Indian archaeology. For with the imported material was an Indian culture which necessarily shared its date. It remained to define that association by careful digging.

Accordingly, through the British Consulate at Pondicherry I approached the French authorities for permission for the Archaeological Survey of India to carry out a restricted excavation. H.E. the Governor (Mr. L. Bonvin) readily granted the request, and the work was carried out in April, May and June, 1945. From Brother Faucheux and from Mr. G. Julia, now Chef des Travaux Publics, and his staff the most generous help was received throughout the proceedings. The work was directed by myself as Director General of Archaeology in India, with the assistance of Mr. A. Ghosh, Superintendent of the Excavations Branch of the Archaeological Survey, Mr. Krishna Deva, Pottery Assistant to the Survey, and the following senior students of the Survey: S. C. Chandra, S. R. Das, D. P. Guha, B. B. Lal and B. K. Thapar. About twenty-five students and attachés from the Indian universities and States also took part in the work.

2. THE CHRONOLOGY OF THE SITE

The imported pottery which dates the site consists of (*a*) Arretine ware from Italy, and (*b*) amphorae from Italy or elsewhere in the Mediterranean. Since the occupation was manifestly continuous through the period when Arretine ware was reaching the site into the period when the importation ceased, it is reasonable to regard the disappearance of the ware as due to stoppage at source rather than to any local condition at Arikamedu. It is inferred therefore that the Arretine imports belong to the last phase of the industry, and the three decades A.D. 20–50 are here suggested as a liberal estimate of the period covered by them.

Below the lowest Arretine-producing stratum on AK II, however, were 8 feet of sandy deposits representing mainly the accumulation of estuarine silt but nevertheless containing relics (fig. 2). All save the lowest of these deposits (which contained very little) yielded sherds of Mediterranean amphora. It may be affirmed therefore that a reasonably regular trade with the West was maintained substantially from the beginning of the occupation, but that, on present showing, the finest foreign ware (Arretine) did not appear at once upon the scene.

At this point we fall back upon the less certain support of historical probability. The historical indications are that the consolidation and development of Roman trade with the East was a product of the unification of the western world under Augustus (23 B.C.–A.D. 14), and it is reasonable to suppose that previous trade with eastern India, if it existed at all, was of a spasmodic and indirect kind—unlikely, for example, to have produced a continuous supply of amphorae at Arikamedu. On historical grounds, therefore, the Roman occupation of this site is unlikely to have antedated the principate of Augustus; i.e. unlikely to be earlier than 23 B.C.

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[1] R. E. M. Wheeler, 'Virāmpatnam', *Journ. of the Greater India Society*, XI (1945), 91ff.

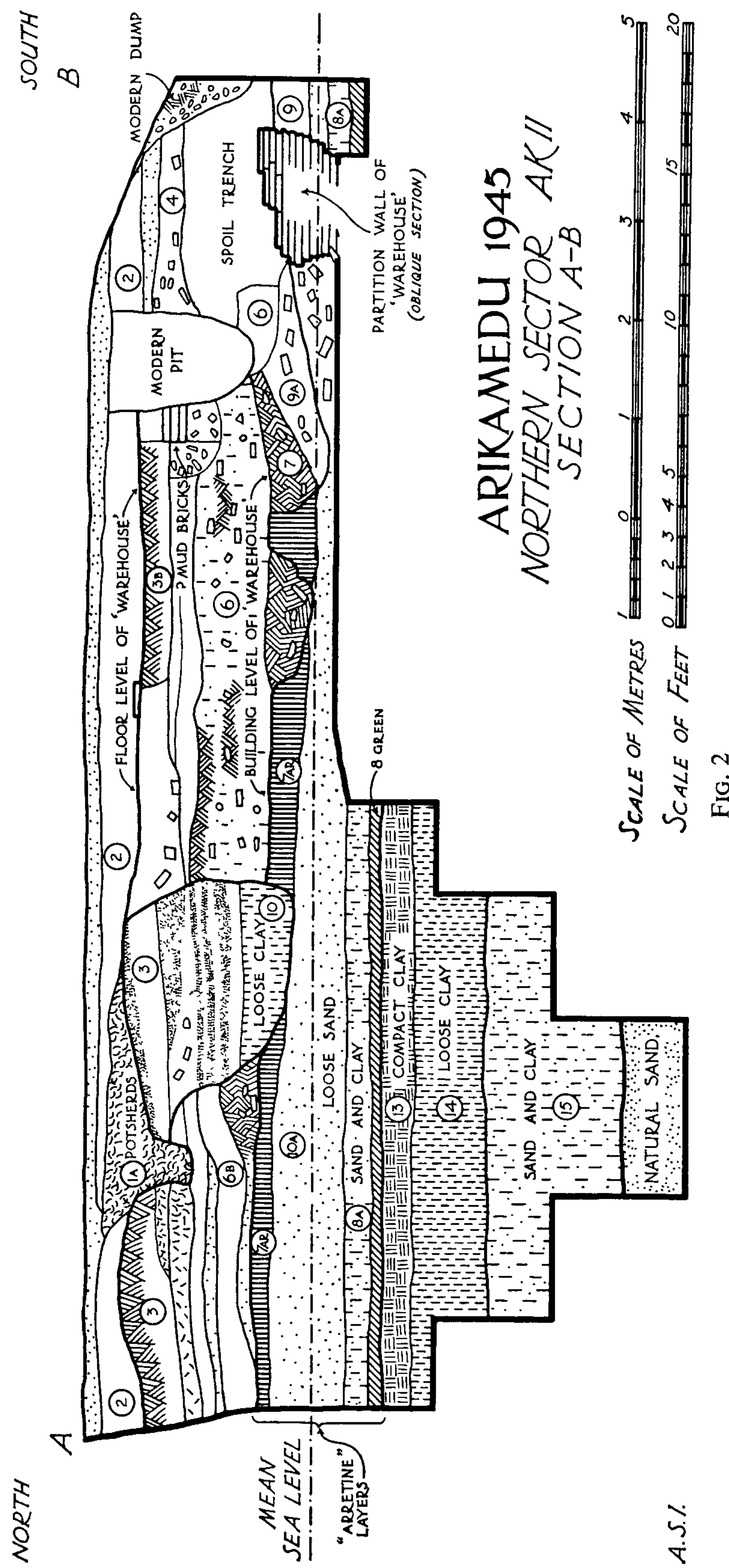

NORTH
A
SOUTH
B
MODERN DUMP
SPOIL TRENCH
MODERN PIT
FLOOR LEVEL OF 'WAREHOUSE'
? MUD BRICKS
BUILDING LEVEL OF 'WAREHOUSE'
PARTITION WALL OF 'WAREHOUSE' (OBLIQUE SECTION)
POTSHERDS
LOOSE CLAY
LOOSE SAND
SAND AND CLAY
COMPACT CLAY
LOOSE CLAY
SAND AND CLAY
NATURAL SAND
8 GREEN
MEAN SEA LEVEL
"ARRETINE" LAYERS
ARIKAMEDU 1945
NORTHERN SECTOR AK II
SECTION A-B
SCALE OF METRES
SCALE OF FEET
A.S.I.

FIG. 2

Thus from a convergence of evidence it is here inferred that the riparian sites excavated in 1945 were first occupied at the end of the first century B.C. or beginning of the first century A.D., with an inclination towards the later date.

The duration of the occupation is more in doubt. Almost all the buildings excavated were constructed after the cessation of the importation of Arretine ware. The large building, here called a warehouse, in the Northern Sector was built on and into the main Arretine-producing layers, and only a few stray sherds occurred in the contemporary 'make-up' or subsequent spoliation. In the Southern Sector all structures, save two fragmentary walls, also post-date the cessation of Arretine. In other words, the intensive structural development of these two areas belongs to the end of the 'Arretine period', here ascribed to *c.* A.D. 50 (before rather than after that date). This helps, incidentally, to drag down the initial phase into the first century A.D., in preference to the preceding century.

Subsequently to our date A.D. 50 there were, in the Southern Sector, several successive stages of construction and reconstruction, accompanied by some modification of the associated Indian pottery. These developments were controlled by two unifying factors: a general continuity in the main units of the plan, and the occurrence in all strata of sherds of Mediterranean amphora. It is evident that the function and contacts of the site remained unchanged.

Within these general limits, the duration of the occupation of the site in years is anyone's guess. A minimum of a century would appear to be required by the changes indicated, but there seems to be no good reason for allowing more than two centuries. A terminal date in the neighbourhood of A.D. 200 would be a reasonable supposition.

The great 'warehouse' in the Northern Sector had vanished long before this date, and a pit, full of potsherds of the first to second centuries A.D., had been cut into the remains of one of its walls. The reason for the doom of this building is not far to seek; it lies at the lower end of the site, its foundations are at the present mean sea-level, and, although its floor was, from the outset, raised to a height of 4½ feet above them, it must have been liable to flooding—even on the necessary assumption that in the first century A.D. the relative level of land and sea here differed considerably from that of the present time.

It is noteworthy that no coins have been found in the ancient levels of the site. Only in the extensive areas of late disturbance, due to systematic brick-robbing in medieval and modern times, do Coḷa coins occur with fragments of the Chinese celadon ware which is almost universal in Asia in and after the ninth century A.D.

In summary, the site generally is assumed to have been occupied during the first two centuries A.D., and to have been despoiled for its bricks in the Middle Ages and later.

3. THE STRUCTURES

NORTHERN SECTOR

AK II, III, V, VI, VII, VIII AND X

The 'warehouse'

Of the two main Sectors excavated, the Northern was an amplification of an area cleared by the French excavators in and after 1941. These earlier excavations had disclosed the south-eastern angle of a large brick building and the remains of a ring-well or soak-pit (R.W. 1) built of pottery rings apparently at a somewhat earlier period. A second ring-well is said to have been found but has not been seen by the present excavators. Two more (R.W. 2 and 3) were found to the north and west respectively of the building in 1945, and a few feet to the south or south-west of the former the French claim to have discovered a brick-lined well in 1944.

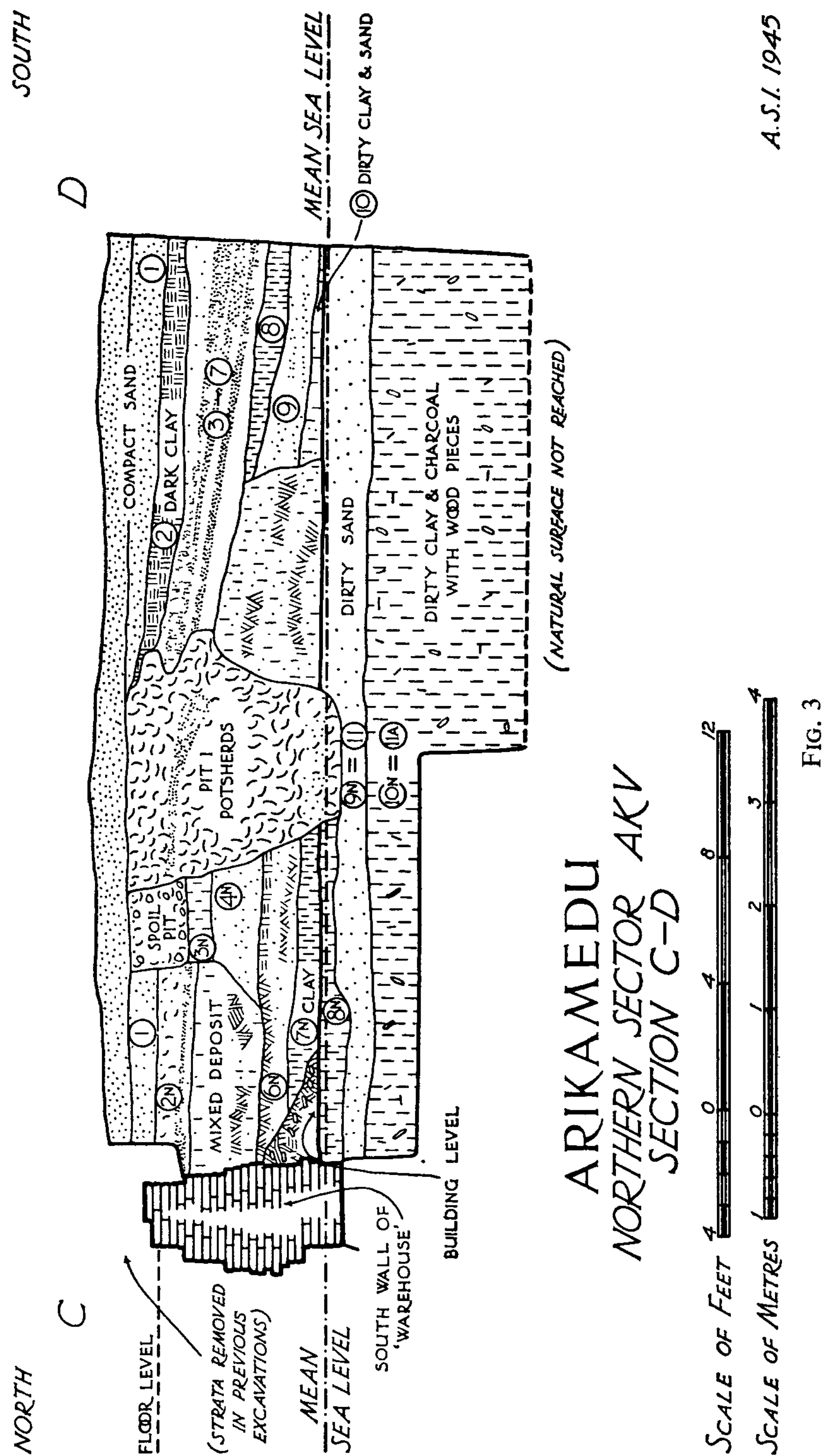

NORTH
SOUTH
C
D
FLOOR LEVEL
(STRATA REMOVED IN PREVIOUS EXCAVATIONS)
MEAN SEA LEVEL
MEAN SEA LEVEL
SOUTH WALL OF 'WAREHOUSE'
BUILDING LEVEL
COMPACT SAND
DARK CLAY
SPOIL PIT
PIT I POTSHERDS
MIXED DEPOSIT
CLAY
DIRTY SAND
DIRTY CLAY & CHARCOAL WITH WOOD PIECES
(NATURAL SURFACE NOT REACHED)
DIRTY CLAY & SAND
ARIKAMEDU
NORTHERN SECTOR AKV
SECTION C–D
SCALE OF FEET
SCALE OF METRES
A.S.I. 1945

FIG. 3

As now revealed the building, largely destroyed by brick-robbers and curtailed by the river, was a featureless structure upwards of 150 feet long (pl. XIII). Traces of a single partition-wall were found, but, apart from a side-chamber towards the east, the building was substantially an oblong shell, massively built and with all the appearance of a warehouse, which it is presumed to have been. Its brickwork had been rendered externally by its builders with a tough plaster, apparently intended to keep out water on this low-lying site; at least, elsewhere at Arikamedu lime-mortar or plaster was only used when it was desired to waterproof walls or floor, as in Tank A on Site AK IV. The bricks themselves were mostly held together with a mud-mortar devoid of lime.

The date of the building was reasonably clear and has been discussed above, p. 24. It was approximately the middle and second half of the first century A.D.

No later structure was found here or hereabouts. It is evident that the 'warehouse' was built on a site which was as near to water-level as was feasible, and that the latter was already rising. The main walls were built on rough foundations of bricks which had been sunk on a rubble bottoming into the soft sand, and the floor-level was 4 feet 6 inches above the lowest course of built brickwork.

For the most part the walls did not remain to a sufficient height to indicate doorways, but a former entrance was identified in the eastern wall of the side-chamber by a gap, at which a thick layer of concreted sand and broken bricks probably represented a street approaching from the east. To the north of this gap, a rectangular mass of brickwork partly covered with concrete suggested the former existence of a ramp or staircase here.

Below sea-level,[1] abundant pottery and fragments of cut timber were found to a depth of no less than 10 feet, but these lower deposits, with two possible exceptions at the top, gave the impression of being estuarine slime into which the objects had sunk, rather than submerged occupation-layers. In other words, the building was erected actually on the foreshore of the estuary, on which apparently timber buildings had already stood and into which the débris of the port had penetrated; it was floored at a level high enough to escape normal flooding, and its external walls were specifically reinforced to keep out water; but, after an occupation which does not appear to have been extensive, it was disused, its bricks were largely removed, and the water-logged site was abandoned, whilst the higher ground to the south (at and around AK IV) remained in use. At a reasonable guess, the abandonment of the Northern Sector may be supposed to have occurred before the end of the first century A.D., i.e. within little more than a generation of the date of construction. Evidence of occupation in the 'warehouse' is slight, and, although superficial disturbance of the area robs this negative evidence of certainty, it is significant that Pit 1 of AK VIII, containing a great quantity of potsherds of first to second century types, was cut into the southern wall of the eastern side-chamber of the building after its demolition.

SOUTHERN SECTOR[2]

AK IV

The site known as AK IV lay along the edge of the river to the south of the second of the two main areas already explored by the French. Whereas in the Northern Sector

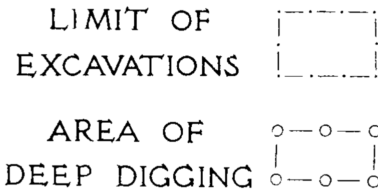
[1] Our excavation in loose sand and clay down to a depth of 13 feet below sea-level was fraught with difficulties, which were overcome by fencing the area with planks, driven lower and lower as the excavation proceeded, and by pumping out water constantly with an excellent pump lent by the Travaux Publics of Pondicherry.

[2] This section of the report is contributed by Mr. A. Ghosh.

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ARIKAMEDU 1945
NORTHERN SECTOR
SITES AK II, III, V, VI, VII, VIII & X
'WAREHOUSE' (*CIRCA* A.D. 50)





AK II
AK III
AK VI
AK VII
AK VIII
AK X
PIT 1
PIT 2
PIT 3
FLOOR
SECTION
A
B
C
D
R.W.1
R.W.2
WELL?
FRENCH EXCAVATION
ARIYĀNKUPPAM RIVER

evidence of occupation penetrated to a depth of 9 feet to 10 feet 6 inches below sea-level, here the natural soil was found at an average height of 10 feet above sea-level. On this higher site, less accessible for the work of the port but out of reach of flood, the evidence of pottery indicates that occupation began a little later than on the foreshore but continued after the foreshore was abandoned. It falls into three main Phases, Early, Middle and Late, with sub-periods, but it should be emphasized at once that there was no break in its continuity, unless between the Middle Phase and the very slight remains constituting the Late Phase.

Early Phase

The Early Phase may be divided into three sub-periods.

Sub-period 1.—The earliest structures were separated from the natural sand by a deposit of greenish sand 3 feet thick, rather poor in pottery and other small finds. The remnants of this sub-period were very few and did not yield any structural plan. They consisted of (1) a fragmentary wall carrying three square blocks of brickwork which doubtless supported wooden posts; (2) a ring-well (R.W. 1) near the southern end of the wall; and (3) a patch of brick floor (Floor A) near by; all the three were to the south of Tank A of the next sub-period; and (4) a wall in the open space between Tanks A and B, entirely over-built by a wall of the next sub-period. An important feature of this wall was that it contained five irregular vertical chases in its eastern face, showing that it was built against wooden posts and roughly cut to fit them. This method of reinforcing an essentially timber structure by a brick 'skin' was repeated in later buildings in the Sector.

At the end of this sub-period a shallow but wide pit was cut into the ground immediately to the west of the wall first mentioned above. This pit yielded a very large quantity of pottery (Group A), which included several interesting sherds, notably a fragment of stamped Arretine, several pieces of amphora, and a sherd with a Prākrit inscription (see below, pp. 36, 43 and 111).

Sub-period 2.—This sub-period witnessed brisk building activity. The main feature was the construction of two complexes of pavements called Tanks A and B, each with an adjacent room of uncertain purpose. Both continued to be repaired and restored till the last sub-period of the Middle Phase. Throughout their existence they seem to have lain at the edge of two large and apparently unroofed quadrangles. They had a close family-likeness to each other and must have been used for similar purposes. The extensive use of drains or conduits and substantial pavements of large bricks apparently made for the purpose, and the absence of domestic features, indicate the probability that the site was used for industrial purposes involving a constant inflow and outflow of water. It is likely enough, though not proved, that the tanks were used as cisterns or vats for dyeing the muslin which formed one of the most important exports of this part of India in ancient times.[1] The yards may have been used for drying the cloth.

Tank A (fig. 4 and pls. XXA, XXIA) was originally paved with bricks four courses deep and plugged with clay and had a doorway in its eastern wall. The portion of the wall to the north of this doorway had an irregular outer face, having been built against wooden posts resting on a single course of bricks. The western and part of the southern walls had an irregular footing, indicating that a part of the tank had been built against the sides of an excavation below ground-level. There is no evidence as to how water was drained out of the tank in this period.

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[1] For the use of brick tanks in the present muslin industry in the Madras Presidency, see p. 34. For Indian muslin exports in classical times, see Warmington, op. cit., pp. 210–12.

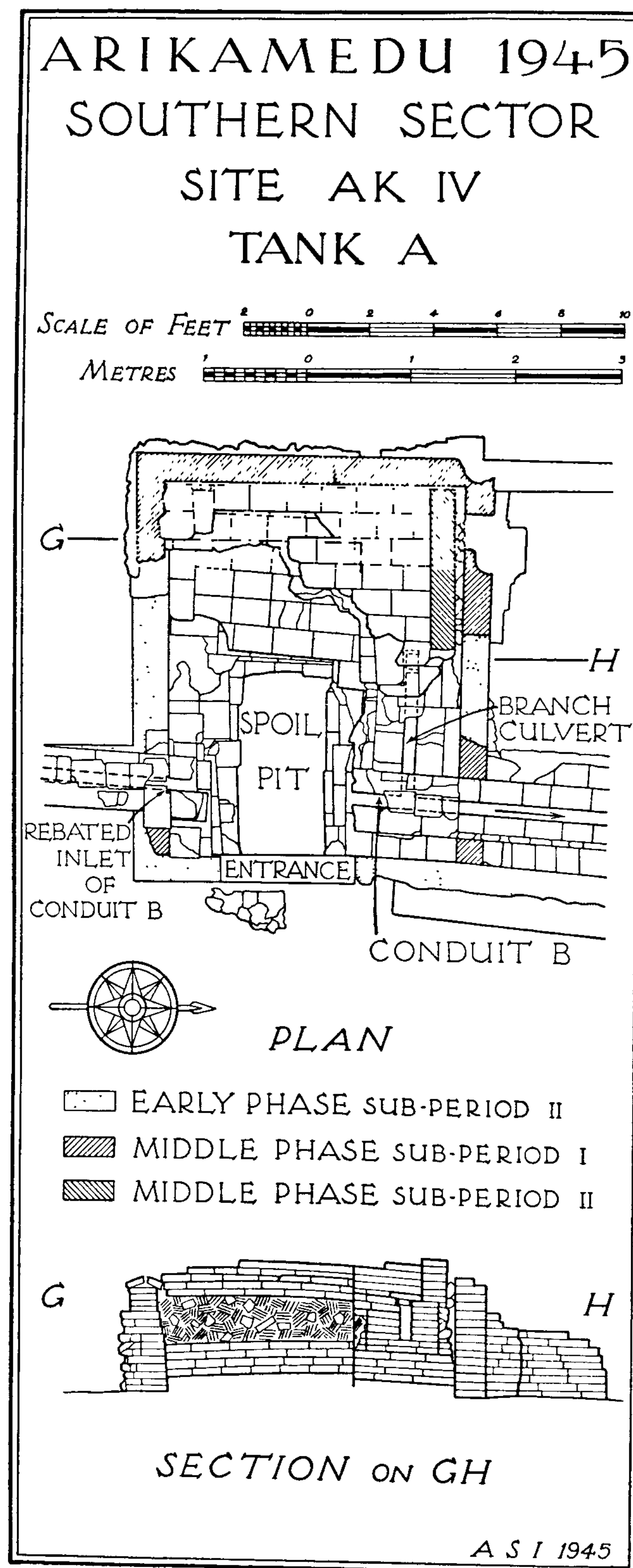
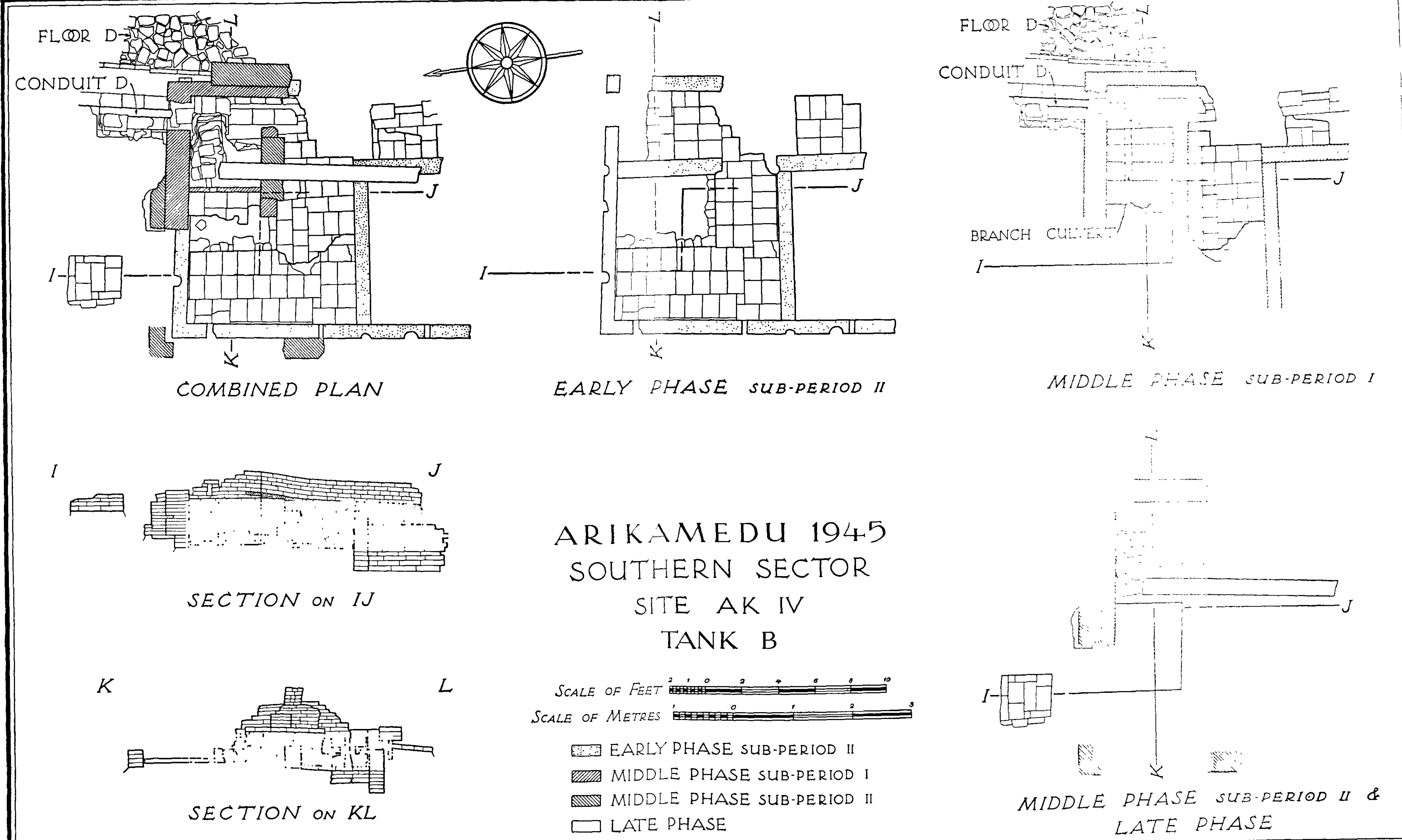

ARIKAMEDU 1945
SOUTHERN SECTOR
SITE AK IV
TANK A
SCALE OF FEET
METRES
G
H
SPOIL PIT
BRANCH CULVERT
REBATED INLET OF CONDUIT B
ENTRANCE
CONDUIT B
PLAN
EARLY PHASE SUB-PERIOD II
MIDDLE PHASE SUB-PERIOD I
MIDDLE PHASE SUB-PERIOD II
G
H
SECTION ON GH
A S I 1945

FIG. 4

To face page 28



Only the southern half of the quadrangle of which the tank formed part was traceable, the northern half having been entirely eroded. The southern wall of this enclosure, which partly overlay the earlier ring-well (R.W. 1), had the same feature as the discarded wall of the earlier period (No. 1 above), in that it supported two square brickwork bases for posts.

Tank B (pls. XVI, XXB), in addition to an unpaved square or oblong chamber to its south, had a paved verandah to its east. The western and northern enclosing walls were built against wooden posts indicated by the semicircular chases cut in their outer faces. Near the junction of the northern and eastern walls there was a doorway opening into the verandah. The partition-wall between the verandah and the tank also had a doorway, flanking either side of which were two holes cut into the floor which were no doubt meant to receive wooden posts forming door-jambs.

A rectangular portion of the north-eastern corner of the tank was left unpaved and contained a platform edged with fragmentary bricks and 9 inches higher than the floor of the tank (pl. XVI). If the conjecture that the two tanks were used for dyeing muslin is correct, this platform may have been used to support a vat.

The tank was drained by two channels in its western wall.

Between Tanks A and B there was a long but fragmentary and unconnected wall, built upon an earlier wall (No. 4, above) and sharing with it the characteristic of having irregular chases in its eastern face and having therefore been originally built against rough wooden uprights. The chases in this wall, however, did not tally in detail with those of the earlier wall, and it is thus evident that a complete reconstruction was involved. It is likely that this new wall served as the western compound-wall of the quadrangle of which Tank B formed part.

Against the outer face of the wall was Conduit A built of two rows of bricks on edge, placed 10 inches apart and capped by horizontal bricks. This is the earliest remnant of the system of drainage which was to become a distinctive feature of the site.

In the French excavation at the northern end of the site, a fragmentary square or oblong structure of uncertain purpose, seven ring-wells (R.W. 2 to 8), and a patch of brick floor (Floor C on plan) may be ascribed to this period on general considerations, although no stratigraphic evidence is preserved.

Of the other extremely fragmentary structures of this period, viz. a brick floor (Floor B) and an isolated wall in the southern extremity of the explored area and two walls in the eastern portion, no coherent plan could be traced, owing to extensive brick-robbing.

Sub-period 3.—The only structure of this sub-period was a wall immediately to the west of the earliest ring-well (R.W. 1). The southern end of this wall overlay the southern wall of the earlier quadrangle. As it was thus later than sub-period 2 and was stratigraphically earlier than the Middle Phase, it has to be regarded as an unconnected structure of the last days of the Early Phase.

Middle Phase

Subsequently to the last period of the Early Phase the site underwent considerable devastation at the hands of brick-robbers, as underlying the structures of the Middle Phase were found four large pits full of brick-fragments (indicated on the plan as Quarry Pits A, B, C and D, cf. pls. XVIIIB, XIXA). This, however, does not imply a general abandonment of the site and its occupation by new settlers. On the contrary, as has been said above, the continued use and elaboration of the two tanks and the renewal of old walls built against wooden posts by similar walls in the Middle Phase indicate a persistence of the essential structural features through the subsequent periods.

The Middle Phase consists also of three sub-periods.

Sub-period 1.—This sub-period became known to the excavators as the 'Drain Period', since it was characterized by the construction of an elaborate system of drainage, sloping north towards the river. In construction all the new drains or conduits, unlike Conduit A of the Early Phase, were constructed by means of corbelled walls (not single bricks on edge), floored and roofed with horizontal bricks.

Conduit B, built upon the ruined top of the eastern wall of the quadrangle of Tank A, first discharged itself into Tank A, whence the water was emptied by another conduit built in line with it through the opposite wall. The end of the inlet was rebated and its side-walls were provided with slits for a wooden sluice-gate (pl. XXIA).

From the extant fragments of the southern end of Conduit C it seems that it had first a northern course; then, after a short turn to the east, it turned again to the north and overlying the earlier Conduit A ran approximately along the median wall between Tanks A and B, which was built upon the earlier wall with chases for timbering and itself had the same characteristic (pl. XXIIA). In fact, this wall and Conduit C were essentially restorations of the corresponding earlier structures.

Conduit D, originating like the others somewhere outside the excavated area, ran through the eastern portion of Tank B, utilizing the earlier floor of the tank as its floor and proceeded northwards till it reached the northern terminal wall of the quadrangle within which Tank B was situated. Beyond this point it continued with a slightly different orientation (as Conduit E), till, crossing a probable street, it discharged itself into a wider cross-drain (Conduit F) which came from the east and probably formed part of the main drainage-system of the town. The point of junction with the main drain was indicated by a gap in the latter (pl. XIXB). It is likely that further west Conduits B and C similarly joined Conduit F.

The relation of Conduit B with Tank A has been described above. The floor of the tank was now raised by 1 foot 4 inches over the earlier floor, the intervening space being filled up by débris. The new floor was drained by a branch-culvert, the entrance to which was stopped by a small square brick plug.

The southern, western and northern walls of the tank were now rebuilt upon the corresponding earlier walls. The outer face of the last wall contained two chases, indicating the position of posts against which it had been built. The eastern wall was missing: it is likely, however, that it too followed the alignment of the earlier wall.

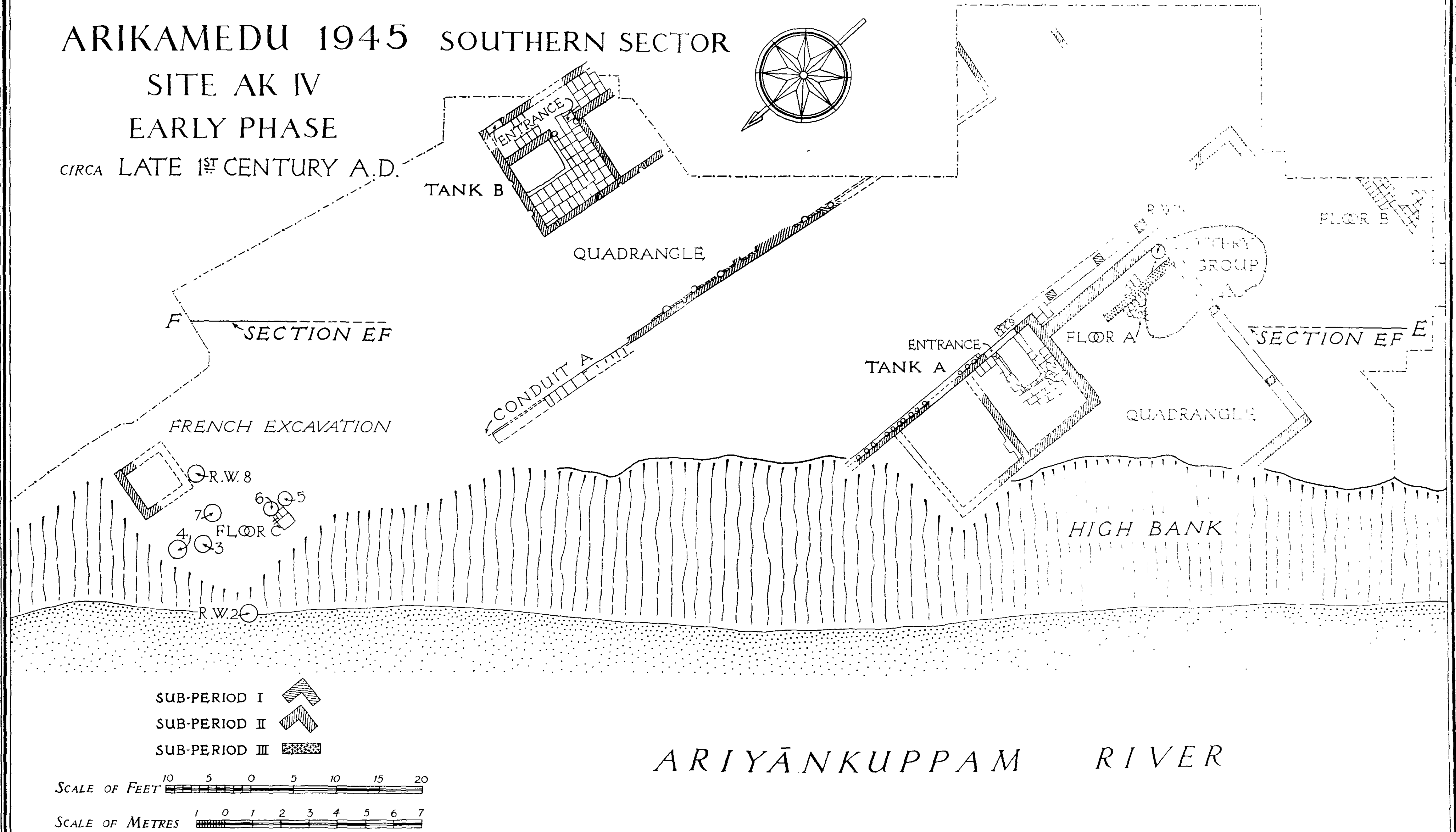
In Tank B, the eastern wall was replaced by a new wall with practically the same alignment and the northern wall was thickened. The partition-wall between the tank and the southern room continued without alteration.

Within the walls of the tank important changes were effected. The partition-wall between the tank and the verandah was discarded, and a new east-to-west wall was erected, partitioning the room into two long strips. Both strips were floored with bricks, the new floors being separated from their predecessors by a deposit of brick-bats and earth. The floor of the northern strip was 8 inches higher, indicating that it now took the place of the earlier platform.

The northern strip itself was divided into two halves by a cross-wall, through which ran a subsidiary drain or conduit taking off from the western half and joining Conduit D through a hole made into one of its cap-bricks. It holds the same position as the branch-culvert in Tank A. The history of the two tanks is thus *mutatis mutandis* identical.

A paved floor outside the eastern wall of the tank, made of fragmentary bricks and edged with bricks on edge, also belongs to this sub-period.

Though the fragmentary remnants render the reconstruction of a complete plan of the sub-period impossible, the general lay-out is fairly clear. Tank B seems to have formed part of a large quadrangle, the wall against which Conduit C was built forming its western


ARIKAMEDU 1945 SOUTHERN SECTOR
SITE AK IV
EARLY PHASE
CIRCA LATE 1ST CENTURY A.D.
TANK B
ENTRANCE
QUADRANGLE
CONDUIT A
F
SECTION EF
FRENCH EXCAVATION
R.W. 8
7
6
5
4
3
FLOOR C
R.W. 2
ENTRANCE
TANK A
FLOOR A
GROUP
FLOOR B
SECTION EF
E
QUADRANGLE
HIGH BANK
SUB-PERIOD I
SUB-PERIOD II
SUB-PERIOD III
ARIYĀNKUPPAM RIVER
SCALE OF FEET
10 5 0 5 10 15 20
SCALE OF METRES
1 0 1 2 3 4 5 6 7
A S I 1945

wall. This wall had two corner projections against its eastern face, indicating the existence of a few small rooms within the quadrangle.

The inner (southern) face of the northern wall of the quadrangle was very rough and was doubtless built against timbering. The eastern wall had regular outer and inner faces, against the latter of which Conduit D was built. The entire length of the southern compound wall was missing, but its position could be guessed from a corner projecting from the western wall.

Flanking the northern wall of the quadrangle was probably a street, with Conduit F running through it.

Unlike Tank B, no quadrangle could be ascribed to Tank A in this period, though it may be assumed from the fact that there was one both in the preceding and the succeeding periods. Three rectangular blocks of brickwork near the eastern face of Conduit B may represent the remnants of a series of piers or posts holding a roof or pent.

The open space between Tank A and the western wall of the quadrangle of Tank B might naturally have been regarded as a street meeting the main east-to-west street mentioned above but for the fragmentary corner of a structure standing in its middle.

In the French excavations immediately to the north of the site, the only buildings of this period were a square structure (Lined Pit A), 9 feet 5 inches deep, gradually narrowing towards the bottom, and a drain (Conduit G) taking off from its lip. The pit is similar in construction to another one (Lined Pit B) found by us and belonging to the next sub-period.

Sub-period 2.—In this sub-period, Tank A was provided with a still higher floor, which finally sealed the opening of the outlet-drain of the previous sub-period. There is no evidence as to how water was drained off the floor.

The tank had now a quadrangle round it, as may be surmised from the existence of two walls to its south and west, at a distance of 19 feet respectively from the corresponding walls of the tank. The former had a door near its western end, and the latter was again built against wooden posts driven into holes cut into the ruined top of the wall of the Early Phase (pl. XVIIIA).

To the south of this quadrangle was a square structure, called Lined Pit B, 5 feet 9 inches deep. Its outer face was roughly built against the earthen sides of the pit; the smooth inner face had an inward batter, so that at the top the structure was 5 feet square and at the bottom only 1 foot 6 inches square (pl. XXIB). It seems likely that this pit as well as the somewhat earlier one in the French excavation (Lined Pit A) were used in connexion with the same industry as Tanks A and B (see above, p. 27).

The northern and western walls of Tank B, to judge from the fragmentary remains, were made thicker; a thick wall was also raised upon the ruined top of the earlier wall dividing the tank into two strips. The space between this and the northern wall was paved with brick-bats and provided with a drain, the outlet of which, however, was not clear.

The other unconnected and fragmentary structures of this period were a thick wall with semicircular recesses in its western face and a part of a small rectangular room of unknown purpose, both in the French excavations.

Sub-period 3.—The main building-activity of this sub-period was confined to the area beyond the southern wall of the quadrangle of Tank A. Along the outer face of this wall a west-to-east drain (Conduit H) was added. The source of the drain was uncertain; but after a breach of 15 feet it reappeared, utilizing one of the earlier walls and a floor (Floor E) built against it as one of its side-walls and floor, a new wall forming its other side. It sloped to join Conduit C of the 'Drain Period' at a point where the latter turned east.

Some brick floors of this period deserve mention. Floor F lay immediately to the north of Conduit H near its lower end. It was built of complete bricks, its sides consisting of bricks on edge. On the other side of the drain was Floor G built of brick-bats. Further west it seems to have been continuous with Floor H, which was similarly built against the same drain, and which, along with two walls of the same period meeting each other at an acute angle, overlay the top of the Lined Pit B of sub-period 2.

There is no evidence that the two tanks remained in use in this sub-period; on the other hand, there is no evidence to the contrary.

Late Phase

All the periods from sub-period 1 of the Early Phase to sub-period 3 of the Middle Phase were connected with one another by structural links, such as similarity of alignment, the continued utilization of older drains, etc. But the last phase of occupation on the site revealed no such connexion with the earlier episodes. It was essentially a period of decay, when a few stray structures, lightly and clumsily built of brick-bats, took the place of the earlier tanks and drains. At the same time, there was very little accumulation of material between the Middle and Late Phases, and there is no good reason for assuming a wide divergence of date between them.

Besides stray walls, three ring-wells (R.W. 9, 10 and 11), all in the southern portion of the site, belonged to this Late Phase. It is likely that all the ring-wells were originally surrounded by brick-floors, R.W. 9 by Floor I, superimposed upon Floor H of the earlier period, and R.W. 10 and 11 by Floor J, only a small patch of which was found near by.

AK I

Unlike the other excavated areas, AK I was situated inland, being at a distance of about 60 yards from the river-bank (pl. VIII). Here an area of 40 feet by 40 feet was partially excavated to the natural soil, which was reached at an average depth of 9 feet from the surface. Slight traces of structural remains belonging to three phases were found. The area had, however, been so thoroughly disturbed by brick-robbers at various periods that the trial was not extended.

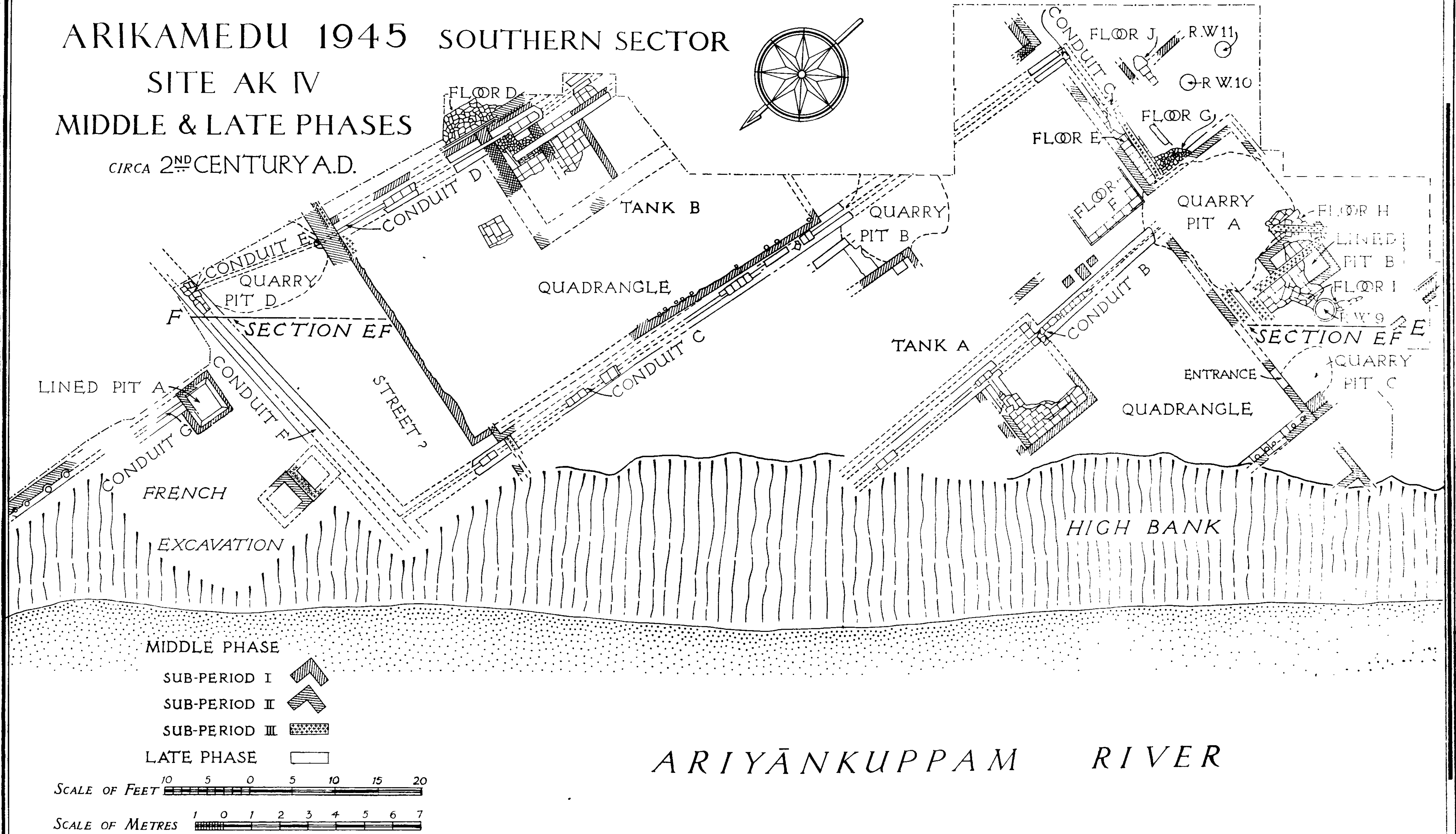
An interesting feature of this otherwise unpromising site was the discovery at a low level of a cluster of eight pointed-bottom jars (type 75 below, p. 77, and pl. XXXIIIA), irregularly distributed within an area of 4 square feet. Some of them were fitted into the broken remains of others.

Dimensions of Bricks

A very large number of bricks was measured, and the appended chart gives the dimensions in inches of those used in walls, drains and pavements of different periods. Besides the maxima and minima of the three dimensions, the chart gives the normal size of bricks in each case. A mathematical average is liable to produce an entirely artificial figure and has been avoided.

Hasty conclusions as to chronology have often been based upon brick-measurements, but, until large numbers of bricks have been carefully measured on a large number of dated sites and the results critically considered, these conclusions are invalid. The tables here printed may perhaps serve as a fresh starting-point.

It will be seen that in the middle of the first century A.D. at Arikamedu (Northern Sector), the normal size was 2·5″ to 2·9″ thick, 14·0″ to 15·0″ long and either 8·0″ to 8·5″ or 10·5″ to 11·0″ broad. The earliest bricks in the Southern Sector, which probably originated a little later in the first century, are 2·7″ × 13·0″ to 13·5″ × 9·0″ and are evidently a different batch. Thereafter there is no appreciable change until sub-period 2 of the Middle Phase (probably second century A.D.), when there is a tendency for the bricks (perhaps re-used) to grow rather larger again, with superficial dimensions 14·0″ to 15·5″ × 9·0″ to 9·5″ or 10·5″ to 11·0″. Pavement bricks had already in sub-period 2 of the Early Phase been 2·7″ to 3·0″ × 15·0″ to 16·0″ × 10·5″ to 11·0″.



ARIKAMEDU 1945 SOUTHERN SECTOR
SITE AK IV
MIDDLE & LATE PHASES
CIRCA 2ND CENTURY A.D.
FLOOR D
CONDUIT D
TANK B
CONDUIT E
QUARRY PIT D
QUADRANGLE
F
SECTION EF
CONDUIT C
QUARRY PIT B
FLOOR J
R.W.11
R.W.10
CONDUIT C
FLOOR G
FLOOR E
FLOOR F
QUARRY PIT A
FLOOR H
LINED PIT B
FLOOR I
R.W.9
E
SECTION EF
CONDUIT B
TANK A
ENTRANCE
QUARRY PIT C
QUADRANGLE
LINED PIT A
CONDUIT F
STREET ?
CONDUIT G
FRENCH
EXCAVATION
HIGH BANK
MIDDLE PHASE
SUB-PERIOD I
SUB-PERIOD II
SUB-PERIOD III
LATE PHASE
SCALE OF FEET
10 5 0 5 10 15 20
SCALE OF METRES
1 0 1 2 3 4 5 6 7
ARIYĀNKUPPAM RIVER
A.S.I 1945

NORTHERN SECTOR

	Max.	Min.	Normal
Length ..	18·0	11·0	14·0 to 15·0
Breadth ..	11·0	7·2	8·0 to 8·5 10·5 to 11·0
Thickness ..	3·0	2·4	2·5 to 2·9

SOUTHERN SECTOR

Early Phase

	Sub-period 1			Sub-period 2						Sub-period 3		
	Walls			Walls			Pavements			Walls		
	Max.	Min.	Normal	Max.	Min.	Normal	Max.	Min.	Normal	Max.	Min.	Normal
Length ..	13·5	13·0	13·0 to 13·5	14·0	13·0	13·0 to 13·5	17·0	12·0	15·0 to 16·0	14·3	13·2	13·5
Breadth ..	9·0	9·0	9·0	9·0	8·8	8·8 to 9·0	11·5	9·0	10·5 to 11·0	9·5	9·0	9·0
Thickness ..	3·0	2·5	2·7	3·0	2·5	2·7	3·0	2·5	2·7 to 3·0	2·7	2·5	2·7

Middle Phase

	Sub-period 1									Sub-period 2			Sub-period 3					
	Walls			Drains			Pavements			Walls			Walls			Pavements		
	Max.	Min.	Normal	Max.	Min.	Normal	Max.	Min.	Normal	Max.	Min.	Normal	Max.	Min.	Normal	Max.	Min.	Normal
Length ..	16·5	12·5	13·0 to 13·5 14·0 to 14·5 15·0 to 15·5	17·5	13·0	14·0 14·5 15·5	16·0	14·5	15·5 to 16·0	17·5	13·0	14·0 to 15·5	16·5	13·3	15·0	16·0	13·0	13·5 to 14·0
Breadth ..	11·0	8·0	8·5 9·0 11·0	11·0	8·5	8·5 9·5 10·5	11·0	10·5	10·5	11·0	8·5	9·0 to 9·5 10·5 to 11·0	10·0	8·2	10·0	11·0	8·5	9·5 to 10·0
Thickness	3·5	2·2	2·5 to 2·7	3·0	2·5	2·7	3·0	2·5	2·7 to 3·0	3·0	2·2	2·7 to 2·8	2·5	2·5	2·5	3·0	2·5	2·5 to 3·0

In all these measurements every possible care has been taken to exclude obviously re-used bricks, but the risk of 'dilution' from this cause in the later periods is always present. The only bricks which were certainly and uniformly new at the time of construction are those of the Northern Sector; of the Southern Sector, Early Phase, sub-period 1; and of the pavements of Southern Sector, Early Phase, sub-period 2.

NOTE ON THE USE OF TANKS IN THE TEXTILE INDUSTRY IN THE MADRAS PRESIDENCY

With reference to the suggested use of Tanks A and B (above, p. 27) for the preparation of muslin cloth, the following answers to inquiries are worthy of record:—

1. Extract from letter dated the 22nd September, 1945, from the Business Manager, Handloom Weavers' Provincial Co-operative Society Ltd., 21 Sunkurama Chetty Street, G-T., Madras.

'Masonry tanks were considered to have no reaction to acids and salts in those days for indigenous dyeing, and they are in existence even now in some parts in South Arcot and Chingleput Districts in cases where much boiling is not required. The tanks may be square or rectangular in shape and the size will generally not exceed either $3 \times 3 \times 3$ feet or $3\frac{1}{2} \times 3$ feet so as to be easy for the workmen to do the work.'

2. Extract from letter dated the 24th September, 1945, from the Principal, Government Textile Institute, Washermanpet, Madras.

'Masonry tanks or cisterns are used for storing water or for dyeing by cold process when there is no need to heat the dye-bath by means of firewood.'

3. Extract from letter dated 22nd September, 1945, from the Secretary, All-India Spinners' Association, Andhra Branch, Masulipatam.

'For printing and dyeing blue colour, masonry tanks are used. The size of these would be generally 4 to 6 feet in length, $2\frac{1}{2}$ feet in width and about 3 feet in depth. They will be rectangular in shape.'

4. Extract from letter dated 13th September, 1945, from the Curator, State Museum, Pudukkottai (S. India).

'Water and large vats or tanks were necessary (1) in the bleaching process—for the production of bleach liquor for soaking the fabric and washing; (2) in sizing and starching, for the boiling of the starch gruel from millets or rice and soaking the fabric; (3) in dyeing or printing, for the boiling of the dye and mordants, steeping the material and for washing it.'

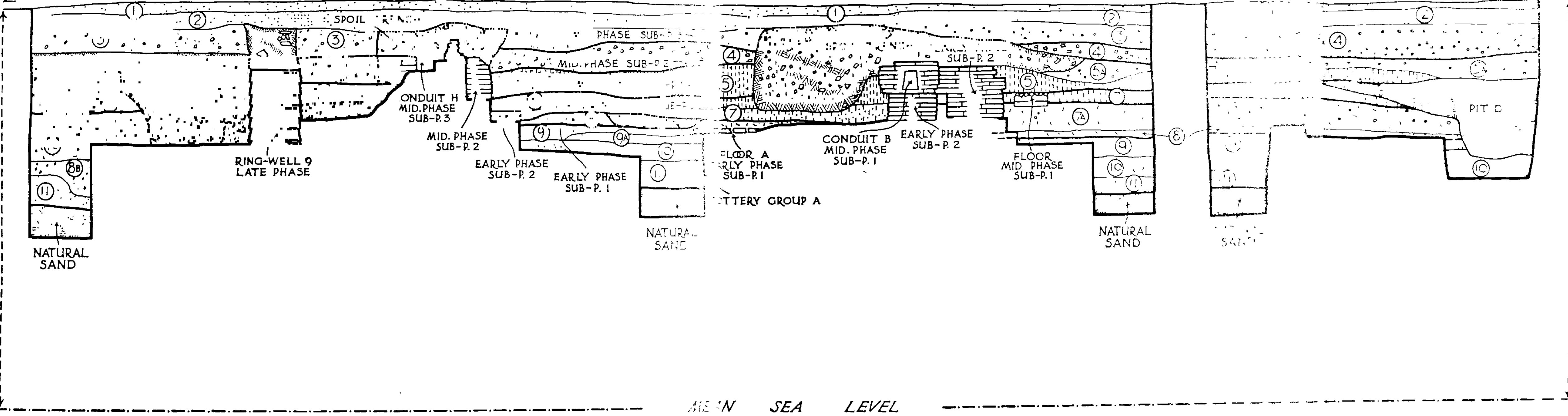
4. THE POTTERY

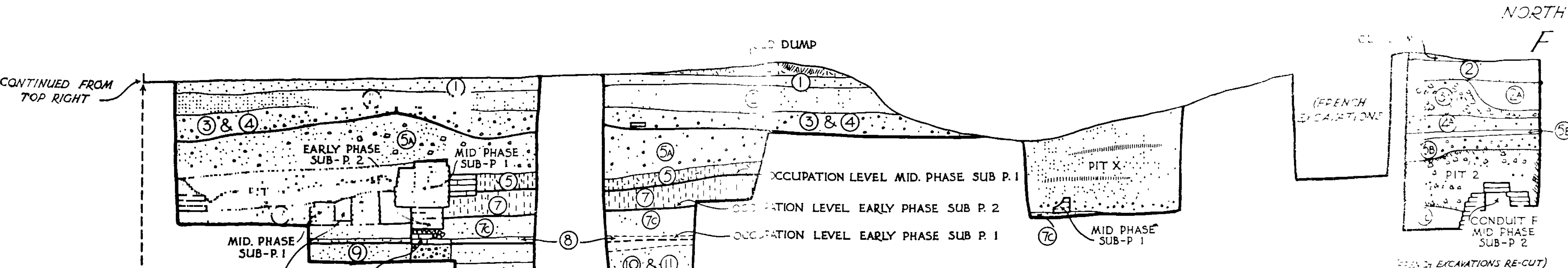
A. WARES IMPORTED FROM THE MEDITERRANEAN

Upon the imported Mediterranean wares the whole chronology of the site, and its special importance therefore to Indian archaeology, depend. Although the apparatus for an analytical and comparative study of these wares does not exist at present in India, their general significance is sufficiently familiar to enable them to be used immediately with adequate precision. They fall into three categories: (i) 'Arretine' ware, with imported copies, (ii) amphorae, and (iii) rouletted black ware, which, whether actually imported or not, shows foreign influence.

(i) *Arretine ware*

This is a red-glazed ware, the glaze varying from a sealing-wax colour through 'Indian red' to something approaching a deep orange-red; occasionally, in the first half of the first century A.D., the glaze is yellow with red veins, the so-called 'marbled' ware. Arretine ware belongs to a class of ware known as *terra sigillata* ('stamped pottery') from the fact that some of it is decorated by being pressed into a stamped mould. Terra sigillata belongs in origin to the eastern Mediterranean area, especially to the environs of the Aegean Sea, and assumes a number of forms and varieties of fabric and glaze which have not yet been adequately systematized. It seems to emerge in the second century B.C., and its derivatives survived in the Near East widely into the Byzantine period—as late as the seventh century





ARIKAMEDU: SOUTHERN SECTOR, AK IV

SECTION E-F



A.S.I 1945

A.D. according to J. H. Iliffe, who has made a useful preliminary study of these provincial wares.[1]

At Arikamedu, however, we are concerned primarily with the highest category of metropolitan sigillata, namely, that which was produced in Italy, at Arezzo, Puteoli and elsewhere, and has been named 'Arretine' from the Latin name of Arezzo (Arretium).[2] This Arretine sigillata originated at an undetermined date probably in the first century B.C. By *c.* A.D. 25 it was confronted in western Europe by rival potteries established in Gaul, in some cases by the Italian potters themselves; and, though it lingered on until after the Roman invasion of Britain in A.D. 43, it was driven from the western market by A.D. 50.

In the East, where provincial rivalry may not have been at first so acute, it is possible (though not proved) that Arretine ware lasted a little longer. It is conceivable (though again not proved) that, in its simpler forms such as are normal at Arikamedu, the ware may even have been retained specifically for export-trade, like the celadon of medieval China (see below, p. 91). In the absence of alternative evidence, however, we must assume the general validity of the results of detailed study in western Europe, and must suppose that no Arretine pottery reached India after A.D. 50.

The literary record makes it clear that Romano-Indian trade remained brisk until long after the middle of the first century A.D. There is furthermore no break in the occupation of Arikamedu at the moment when Arretine ware ceased to arrive there. It is a fair inference therefore that the latest Arretine on the site belongs to the last phase of the production of the ware, i.e. *c.* A.D. 45–50; and, in considering the initial moment of Roman contact, we may reasonably argue backwards from that date. Such argument is necessarily somewhat subjective, but in the cutting where the evidence was clearest (AK II, see fig. 2) only four layers, all of them of sandy estuarine mud likely to have been deposited quickly, contained Arretine sherds, and little more than thirty years might be regarded as sufficient for their accumulation.

So far as it goes, the character of the pottery itself is consistent with this. Save for one tiny fragment, probably of Dragendorff's form 11, with leaf-pattern (fig. 7, 32 and pl. XXIV, 4), the sherds represent undecorated cups and dishes, in some cases even without the normal rouletting. These negative features may be regarded as symptoms of lateness; although it may also be supposed that only the cheaper products of the kilns were used for this overseas trade, particularly since the fabric was in any case technically superior to that of the Indian pottery of the period and would therefore find a ready market.

I have proposed therefore A.D. 20–50 as the inclusive period for the Arretine pottery at Arikamedu.

The stratum which produced most of the sherds of Arretine on site AK II (thirteen out of a total of eighteen from the cutting) is shown as '7 Ar.' on the section, fig. 2, and was approximately at the present mean sea-level. Below it, a succession of sandy deposits contained pottery to a further depth of 10 feet, beyond which clean sand, devoid of relics, was encountered. Of this further 10 feet, only the uppermost 2 feet (layers 8A, 8 green, and 11C) yielded sherds of Arretine, to the total number of four. There were thus still 8 feet of accumulation, the pottery from which did not include Arretine.

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1 'Sigillata wares in the Near East', *Quarterly of the Department of Antiquities in Palestine*, VI (1938), 4ff.

2 The phrase *vasa arretina* (Arretine pottery) was retained by the Romans in the sense of pottery *de luxe* even after the actual potteries of Arretium had ceased production. Standard references to this ware include H. Dragendorff, *Bonner Jahrbücher*, XCVI-XCVII (1895-6); S. Loeschcke, 'Keramische Funde in Haltern', *Mitteilungen der Altertums-Kommission für Westfalen*, V (Munster i.W., 1909); E. Ritterling, 'Das frührömische Lager bei Hofheim im Taunus', *Annalen des Vereins für nassauische Altertumskunde* (Wiesbaden, 1913); F. Oswald and T. Davis Pryce, *Terra Sigillata* (London, 1920).

Above stratum 7 Ar. only one sherd of Arretine was found in an undisturbed deposit: in stratum 5, which formed a part of the make-up of the floor-level of the 'warehouse', a brick building constructed on and into stratum 7 Ar.

Otherwise, the most significant occurrence of sigillata was on the main southern site, AK IV, where a stamped sherd immediately underlay a brick wall of the Early Phase.

By sites, the Arretine ware found during the present excavations was as follows (all from the Northern Sector except AK IV), together with some sherds from the previous excavations.

ARRETINE SHERDS, STRATIFIED. Fig. 5

AK II

(*a*) *From the make-up of the floor of the 'warehouse'.*

1. Fragment of flat base of dish. (AK II, 589.)

(*b*) *From stratum 7 Ar.*

2. Fragment of rouletted rim of Loeschcke type 2A. (AK II, 342.)
3. Flat base of dish possibly of similar type, stamped VIBIE (see p. 39). Indeterminate graffiti on under side of base. (AK II, 266.)
4. Fragment of similar dish. (AK II, 312.)
5. Fragment of carinated side of very thin, fine fabric, variant of Dragendorff type 8 or Loeschcke type 15. Approximates to a stamped example of Claudian date (A.D. 41–54) from Mainz (Oswald and Pryce, op. cit., pl. XXXIX, 14). (AK II, 311.)
6. Minute sherd with internal groove, possibly fragment of Loeschcke type 10A, but too small for reasonable conjecture. (AK II, 344.)
7. Fragment of flat base of dish. (AK II, 343.)
8. Fragment of rouletted rim of Loeschcke type 2A or similar. (AK II, 314.)
9. Fragment of base-ring of dish. (AK II, 298.)
10. Indeterminate fragment of 'marbled' ware (yellow with red veins). This type of ware was being produced by Arretine potters at least as early as the beginning of the first century A.D. (see p. 34). (AK II, 506.) Not illustrated.
11. Fragment of Dragendorff type 17 or Loeschcke type 3B. (AK II, 587.)
12. Fragment of flat base of dish with ring of fine rouletted pattern on upper surface. (AK II, 587*a*.)
13. Fragment of variant of Loeschcke type 3B. (AK II, 530.)
14. Fragment of flat base of dish of 'marbled' ware. See above, under No. 10. (AK II, 410.)

(*c*) *Layer 8A* (*prior to 7 Ar.*).

15. Fragment of flat base of dish with incised line on interior. (AK II, 397.)

(*d*) *Layer 11C* (*cut into and therefore later than layer '8 green'*).

16. Fragment possibly of variant of Loeschcke or Dragendorff type 8. Orange-red glaze. (AK II, 517.)

(*e*) *Layer 8 green* (*lowest Arretine layer*).

17. Fragment of flat base of dish. (AK II, 550.) Not illustrated.

AK IV

(*f*) *Pottery Group A* (*earlier than the earliest, save one, of the brick structures on the site*).

18. Base, form indeterminate, stamped ITTA (see p. 40). Fragmentary graffito (svastika ?) on under side. The glaze is of mediocre quality and is orange-red. (AK IV, 154.)

AK V

(*g*) *Pit 1, high up outside S. wall of warehouse.*

19. Fragment of dish-like bowl, variant of Dragendorff type 24. Red glaze on exterior of rim, yellow glaze on interior, and possibly on exterior below rim. (AK V, 61.)



A. *AK IV: wall of Early Phase, with post-holes and superimposed wall of Middle Phase*



B. *AK IV: wall of Middle Phase built over débris*



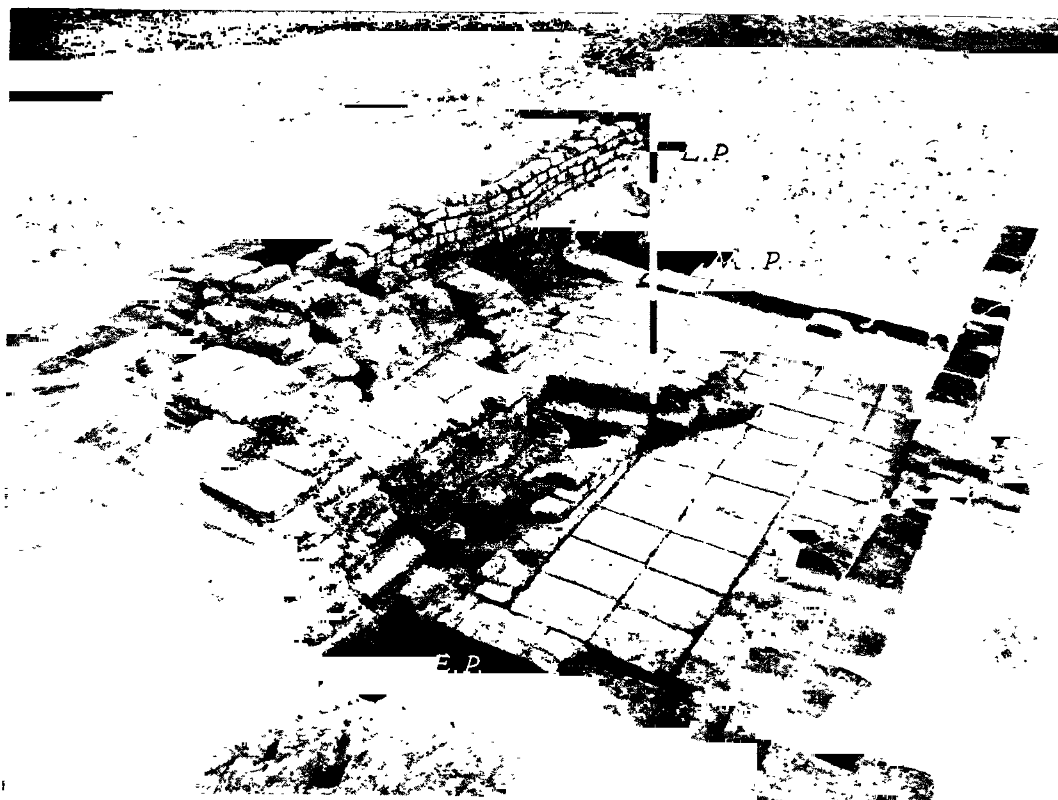
A. *AK IV: walls of Middle Phase built over 'quarry-pit A'*



B. *AK IV: 'conduit F' with junction of 'conduit E'*



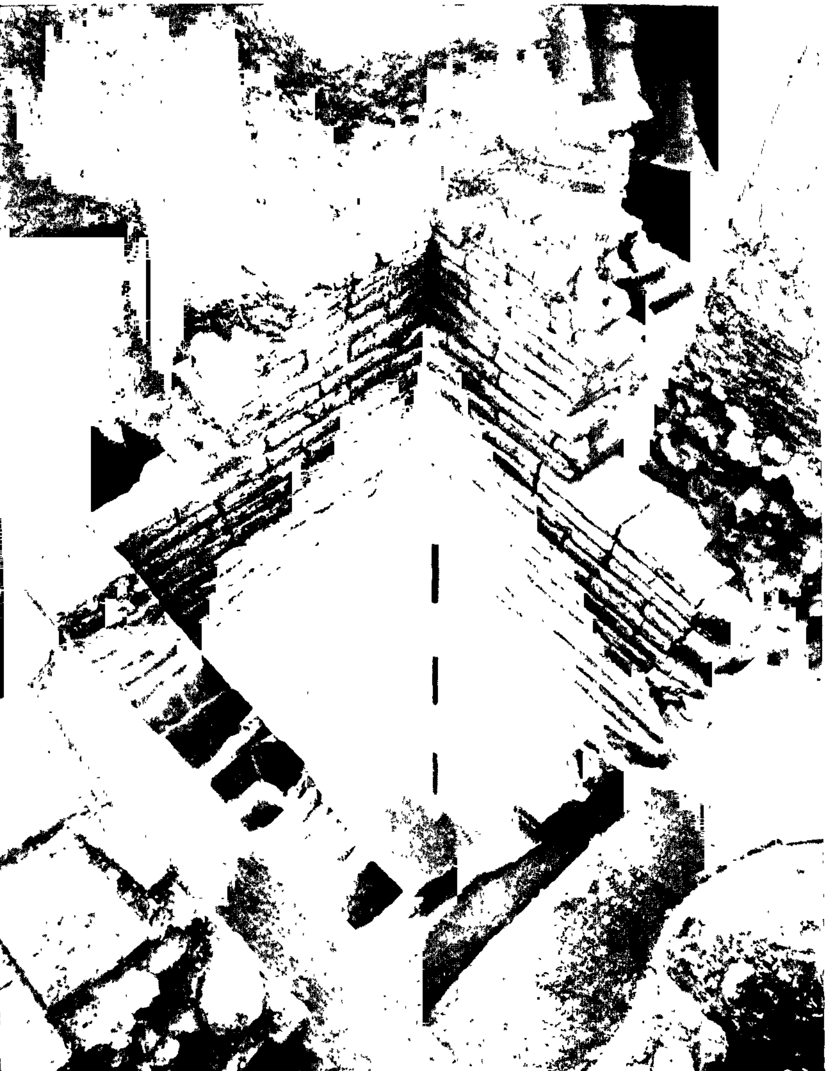
A. *AK IV: 'tank A' showing two main periods of flooring*



B. *AK IV: 'tank B'. E.P. = Early Phase, M.P. = Middle Phase, L.P. = Late Phase*



A. *AK IV: 'tank A', rebated inlet of 'conduit B'*



B. *AK IV: 'lined pit B'*

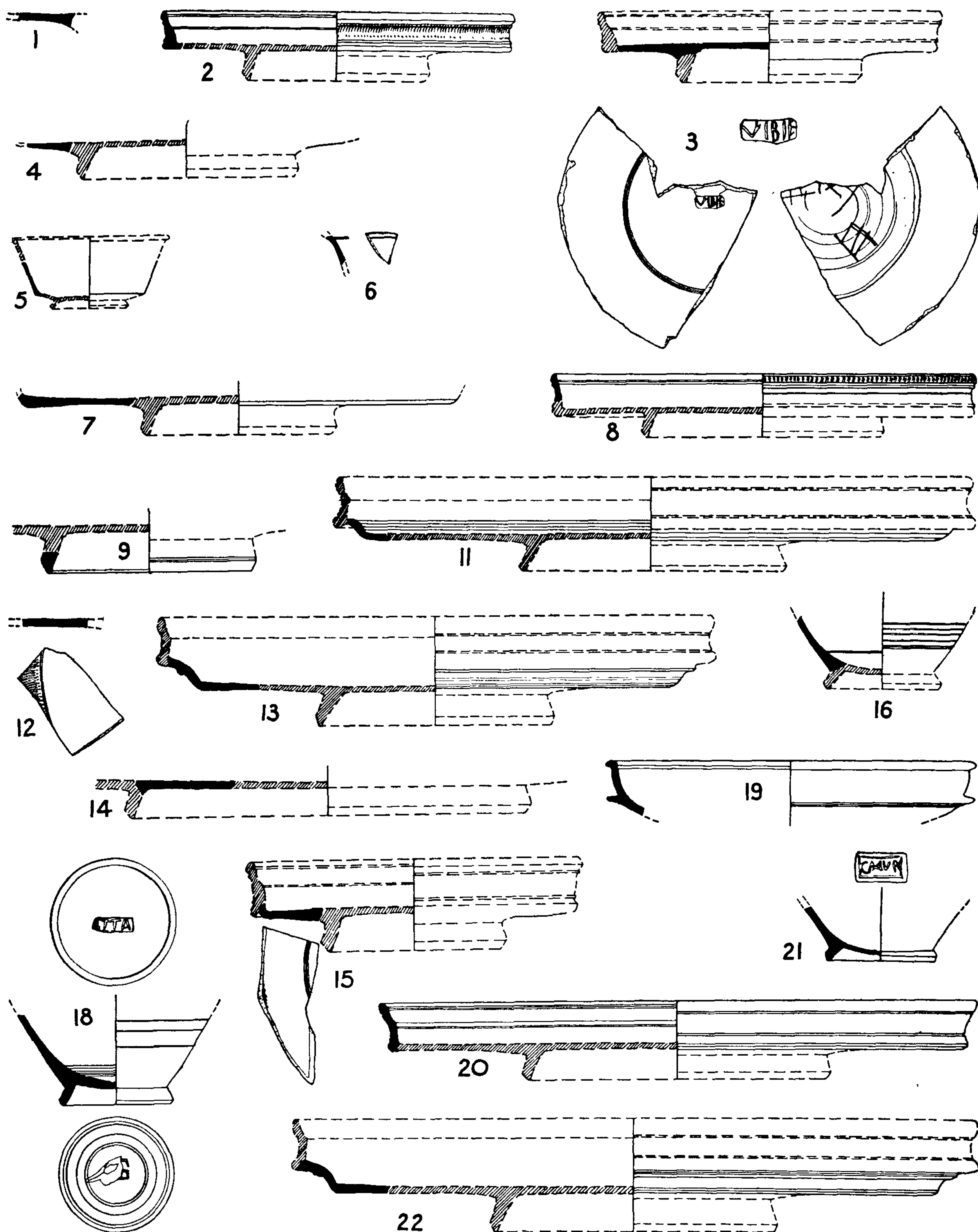


FIG. 5. *Arretine pottery from stratified layers, 1945.* $\frac{1}{3}$ *(potters' names in 3, 18 and 21,* $\frac{2}{3}$*)*

AK VII

(*h*) *Pit 2A* (*high up; cf. AK V, Pit 1*).

20. Rim of Loeschcke type 2A or variant. (AK VII, 14.)
21. Base possibly of Loeschcke type 8 or Ritterling type 5, with stamp CAMVRI (see p. 40). (AK VII, 15.)

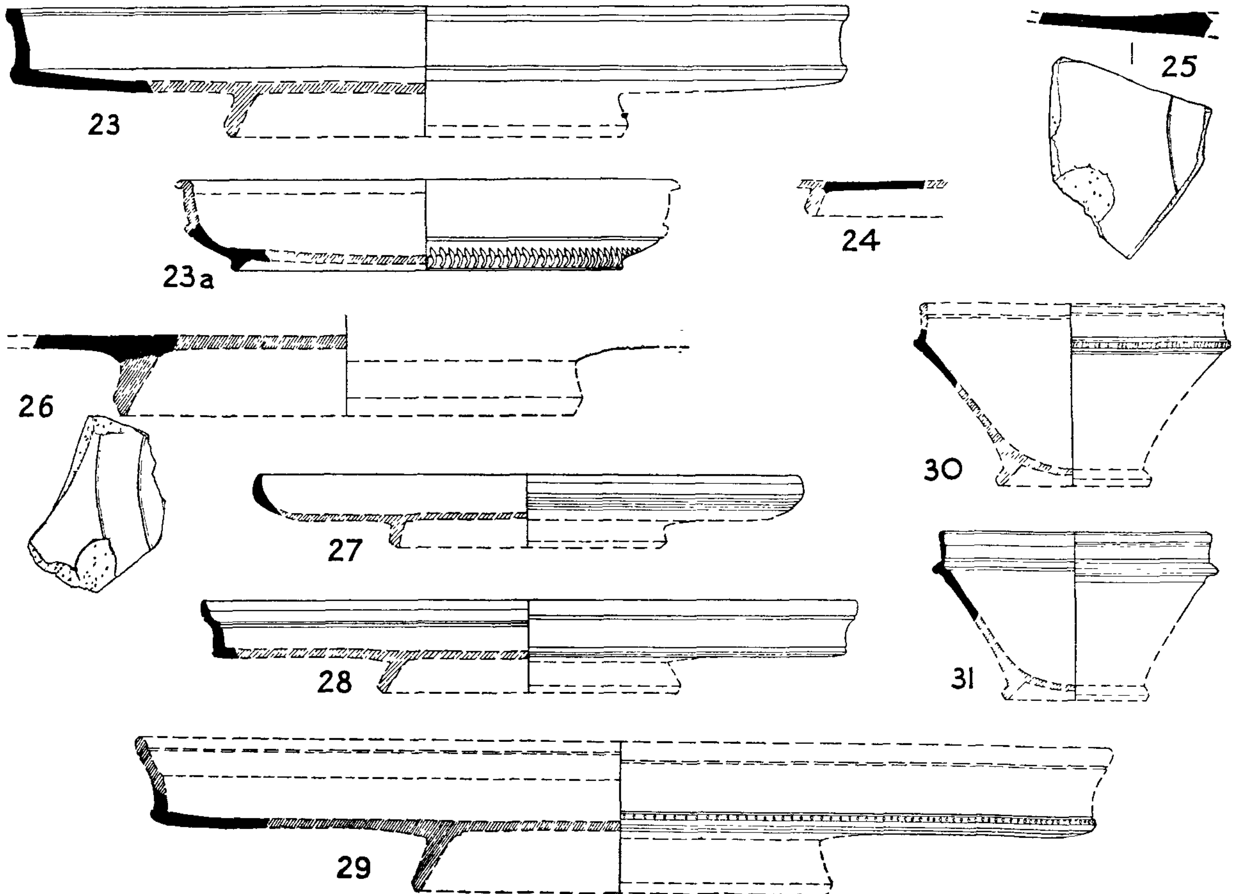


FIG. 6. *Arretine pottery from mixed layers, 1945.* $\frac{1}{3}$

AK VIII

(*i*) *Pit 1, cut into wall of warehouse, and therefore subsequent to it.*

22. Variant of Dragendorff type 16 or Loeschcke type 3. (AK VIII, 49.)

ARRETINE SHERDS FROM MIXED LAYERS. Fig. 6

23. Variant of Loeschcke 2A or Dragendorff type 17. Cf. Oswald and Pryce, op. cit., pl. XLII, 9–11 (Tiberio-Claudian, *c.* A.D. 25–50). (AK II, 452.)

23*a*. Sherd of imitation or provincial terra sigillata, of reddish grey fabric with light red glaze and very rough external rouletting. (AK II, 399.)

24. Fragment of flat base of dish. (AK II, 482.)
25. Fragment of base of dish with incised line on interior. (AK II, 503.)
26. Fragment of base of dish with two concentric incised lines on interior. (AK II, 602.)
27. Fragment of rim of Loeschcke type 4B or Ritterling type 1. (AK IV, 187.)
28. Rim of Loeschcke type 2. (AK X, 2.)



A. *AK IV : wall of quadrangle of 'tank B', showing Early and Middle Phase, with chases for timbering*



B. *Type 1, rouletted ware*

To face page 39



A. *Arretine stamp VIBIE or VIBIF*



B. *Arretine stamp CAMVRI*



C. *Arretine stamp ITTA*
Scale 2 : 1

29. Variant of Loeschcke type 2. (AK X, 3.)
30. Fragment of rouletted rim of Loeschcke type 8 or Ritterling type 5. (AK X, 4.)
31. Rim of Ritterling type 5. No rouletting. (AK X, 1.)

ARRETINE POTTERY FROM THE PREVIOUS (FRENCH) EXCAVATIONS. Fig. 7

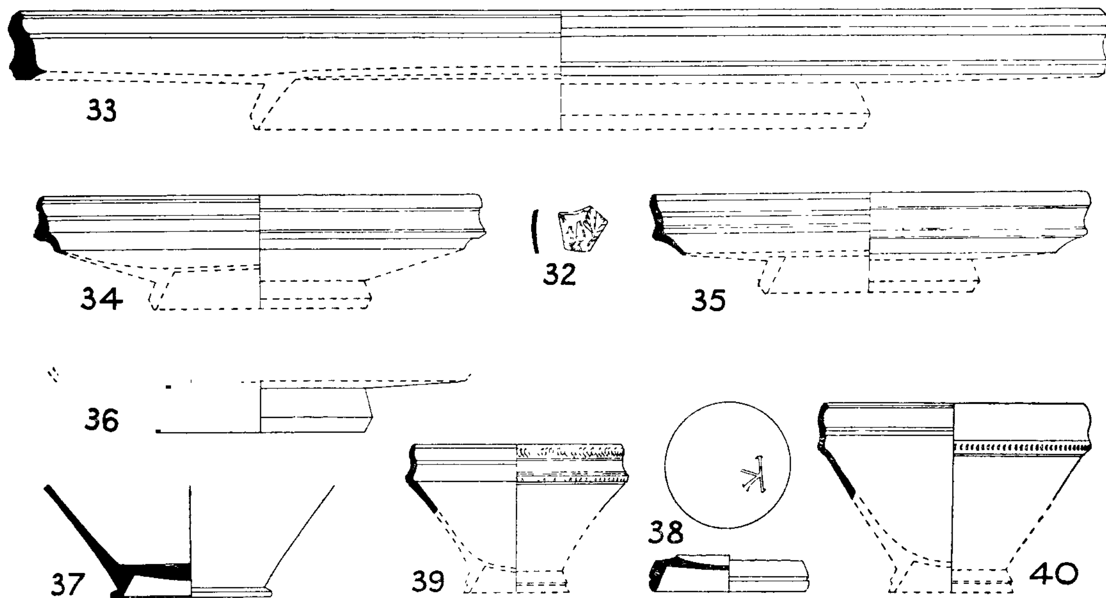


FIG. 7. *Arretine pottery from the previous (French) excavations.* $\frac{1}{3}$

These sherds are unstratified, but Nos. 37 and 38 are said to have been found at a depth which would equate them with our Arretine-producing layers on AK II.

32. Fragment of fine ware with leaf-pattern impressed from a mould. The sherd is too small to indicate form; possibly Dragendorff type 11. Pl. XXIV, 4.
33. Fragment of large dish, Loeschcke type 2A.
34. Fragment of dish, Loeschcke type 3B.
35. Ditto. Pl. XXIV, 1.
36. Base of dish.
37. Base of cup, with indeterminate fragment of potter's stamp.
38. Base of cup, probably Loeschcke type 8 or Ritterling type 5. On the under side of the base is a graffito K or, more probably, Brāhmī *a*. Pl. XXIV, 3.

39, 40. Cups of Loeschcke type 8 or Ritterling type 5. Pl. XXIV, 2, 5.

POTTERS' STAMPS ON ARRETINE WARE (pl. XXIII and fig. 5)

1. VIBII—(probably VIBIE, possibly VIBIF). On the interior of the flat base of a dish, form uncertain. Found on Site AK II, layer 7 Ar. There seem to have been two families of Arezzo potters, the Vibii and the Vibieni, to the latter of whom this stamp would appear to belong, but no attempt has been made to distinguish their respective work and date. Miss M. V. Taylor, to whom I have referred the problem, has very kindly spent much time in looking up the appropriate literature at Oxford, and the following is a summary of her report. 'The first and perhaps best account is by Gamurrini in *Notizie degli Scavi*, 1883, pp. 451ff. He says that the potteries of the Vibieni at Arezzo were near those of M. Perennius and P. Cornelius by S. Maria in Gradi, and worked both before and after them. On the death of C. Vibienus, his sons succeeded to the industry.

What their relation was with the pottery of "Vibius" is not clear, or which employed the other, but the Vibieni and Vibii descended from an ancient Etrurian family, the Vibia, whose name is still preserved in Bibbiena. In any case, north of Arezzo, close to S. Domenico, was the pottery of A(ulus) and C(aius) Vibius who, according to coins found, worked in the second and first centuries B.C. After the death of C. Vibius, the industry was carried on by his workers, Athenius and others. The names of workers with the Vibii include A. Vibius, C. Vibius and L. Vibius (*Corpus Inscriptionum Latinarum*, XI, 6,700, 765ff.; XV, 5,750–60; XIII, 10,009, 290–300).

'Loeschcke, in *Mitteilungen der Altertums-Kommission für Westfalen*, V (1909), 186, says that, since the Vibii are found at Mont Beuvray, Neuss, Trion, Vechten and Xanten but do not occur at Haltern (occupied 11 B.C.–A.D. 16), they evidently flourished before the latter dates. He does not, however, distinguish between the two families of Vibii and Vibieni, and most of his evidence appears to relate to the Vibii. T. Knipowitsch, *Die Keramik römischer Zeit aus Olbia* (1929), 9, No. 3, Abb. 2 and p. 12, gives VIBIE (might be VIBIF), and, basing on Loeschcke, dates it to the last years of the first century B.C. The collection however has no independent documentation. Iliffe (op. cit. on p. 35, above) records VIBI and C. VIBI on dishes from the agora at Athens, but again there is (at present) no independent dating. On the other hand, F. Oswald in his *Index of Stamps on Terra Sigillata* ascribes C. Vibius of Montans, in southern France, to the period Claudius-Vespasian (*c.* A.D. 41–79).'

It would appear therefore that members of the Vibia family were producing Arretine or related pottery from the beginning of the first century B.C. until after the middle of the first century A.D., though in the latter stages only derivative provincial wares are in question. The evidence is consistent with an earlier initial date for the Arikamedu series than I have suggested above (p. 22), but is far too confused to be determinate.

2. CÂMVRI. On the interior of the flat base of a cup, probably Loeschcke type 8 or Ritterling type 5. Found on AK VII in Pit 2A, probably contemporary with the 'warehouse'. The stamp is somewhat blurred, but the cross-stroke of the A appears to have been amalgamated with the right instead of the left half of the M.

The stamp of Gaius Amurius occurs on Arretine at Olbia (Knipowitsch, as cited above), at Beisan in Palestine, at Alexandria, and in the Athens agora. See Iliffe, as cited above. In at least three instances it is recorded on dishes of Dragendorff's form 18; this form is characteristic of the last phase of Arretine production, but the date of its introduction is unknown. It occurs also on the dish known as 'Ritterling 5' which is found at Hofheim in the Claudian period (A.D. 41–54).

3. ITTA. On the interior of the flat base of a dish, form uncertain, with an orange-red glaze. Found on AK IV in Pottery Group A which just antedated the earliest, save two, of the brick walls on that site.

Possibly a retrograde stamp of the Augustan potter P. Attius. It is uncertain where he worked (? Puteoli or Arezzo). Iliffe records his stamp from the Athens agora, and it has been found (ATTI) at Mainz on Arretine of Ritterling type 5 in 'marbled' ware (Behn, *Römische Keramik*, Abb. 10, 1; whence Oswald and Pryce, op. cit., pl. XXVIII, 1), and at Haltern (Loeschcke Nos. 117 and 118). His wares were therefore in use within the period 11 B.C.–A.D. 16, the period of the occupation of Haltern.

Copies of Arretine forms, and related wares (fig. 8)

Close copies of Arretine forms at Arikamedu are restricted to Dragendorff type 24/25, a small bowl with rouletted rim. The copies are of a hard greyish buff ware with polished surface, and differ in fabric sufficiently from the local wares to make it reasonably certain

that they are imports. Two examples were found in the recent excavations, one of them in a layer which also produced Arretine pottery. Other examples, of which two are illustrated (fig. 8, 44-5 and pl. XXIV, 6), were found previously by the French excavators.

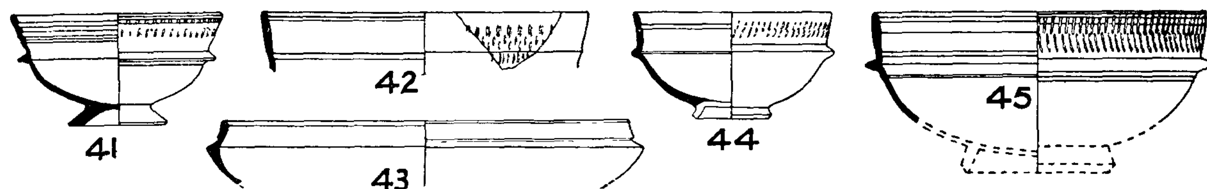


FIG. 8. *41-2 and 44-5, copies of Arretine forms; 43, similar fabric.* $\frac{1}{3}$

Occasional sherds of similar fabric but less distinctive form probably also represent imported wares.

41. From AK II, level 8A, which also produced Arretine sherd No. 15. Copy of Dragendorff type 24/25 (Loeschcke type 12 or Ritterling type 6). Rouletted rim. Hard, polished greyish buff ware, grey below. (AK II, 456.)
42. From AK VII, level 3AN, contemporary with 'warehouse'. Fragment of bowl with rim rebated for lid. Not an Arretine form, but of the same foreign fabric as Nos. 44-5. (AK VII, 33.)
43. From a layer immediately overlying No. 42. Fragment of rouletted rim, probably of imitation of Dragendorff type 24. Grey ware, reddish buff surface. (AK VII, 34.)

44 and 45. From the French excavations of 1943, said to have been found at '0·60 metres below sea-level', i.e. at approximately the same horizon as the lowest Arretine sherds from the present excavations. Copies of Dragendorff type 24/25. Hard polished greyish buff ware.

(ii) *Imported amphorae*

Sherds of amphorae of Mediterranean type and fabric were found on all the excavated sites in every significant stratum, with the exception of the lowest (layer 15) on AK II. This layer probably represents the old foreshore, and did not yield much pottery of any kind. The exception is not therefore of importance; and it may fairly be said that, unless for a few superficial and fragmentary walls built of re-used brickbats largely in disturbed soil, the importation of amphorae continued throughout the occupation of the town, as excavated.

The function of the amphorae was doubtless that for which these vessels were commonly used in their lands of origin: namely, to contain wine or oil. Reference has already been made (above, p. 21) to Tamil records of the ancient importation of wine into India from the West, and many of the sherds of amphora from Arikamedu, including the earliest stratigraphically, preserve an internal incrustation which, on analysis, is found to contain resin,[1] a common constituent of Mediterranean wines.

A majority of the sherds is too fragmentary for a reconstruction of the types represented. But a number of them are of a pink fabric with yellow slip which, in Europe, is commonly of a date before rather than after the middle of the first century A.D.; and some of the handles are of the rectilinear and high-shouldered profile to which a similar dating applies. Stratigraphically it would appear that the arrival of amphorae preceded that of Arretine ware (notably on AK II; see above, p. 22), and amphorae continued to be imported or at least used for a considerable time after the introduction of Arretine ware had ceased. Thus on site AK IV, the earliest, save two, of the brick walls overlay a sherd of Arretine (which in turn overlay a stratum containing amphorae), but amphora-sherds are found in *all* strata which can be related to the subsequent structural phases.

[1] Information from the Chemist of the Archaeological Survey of India.

In the course of the 1945 excavations, 116 amphora sherds, representing approximately the same number of vessels, were found. All sherds showing any part of the shape of the vessel are here illustrated (figs. 9 and 10).

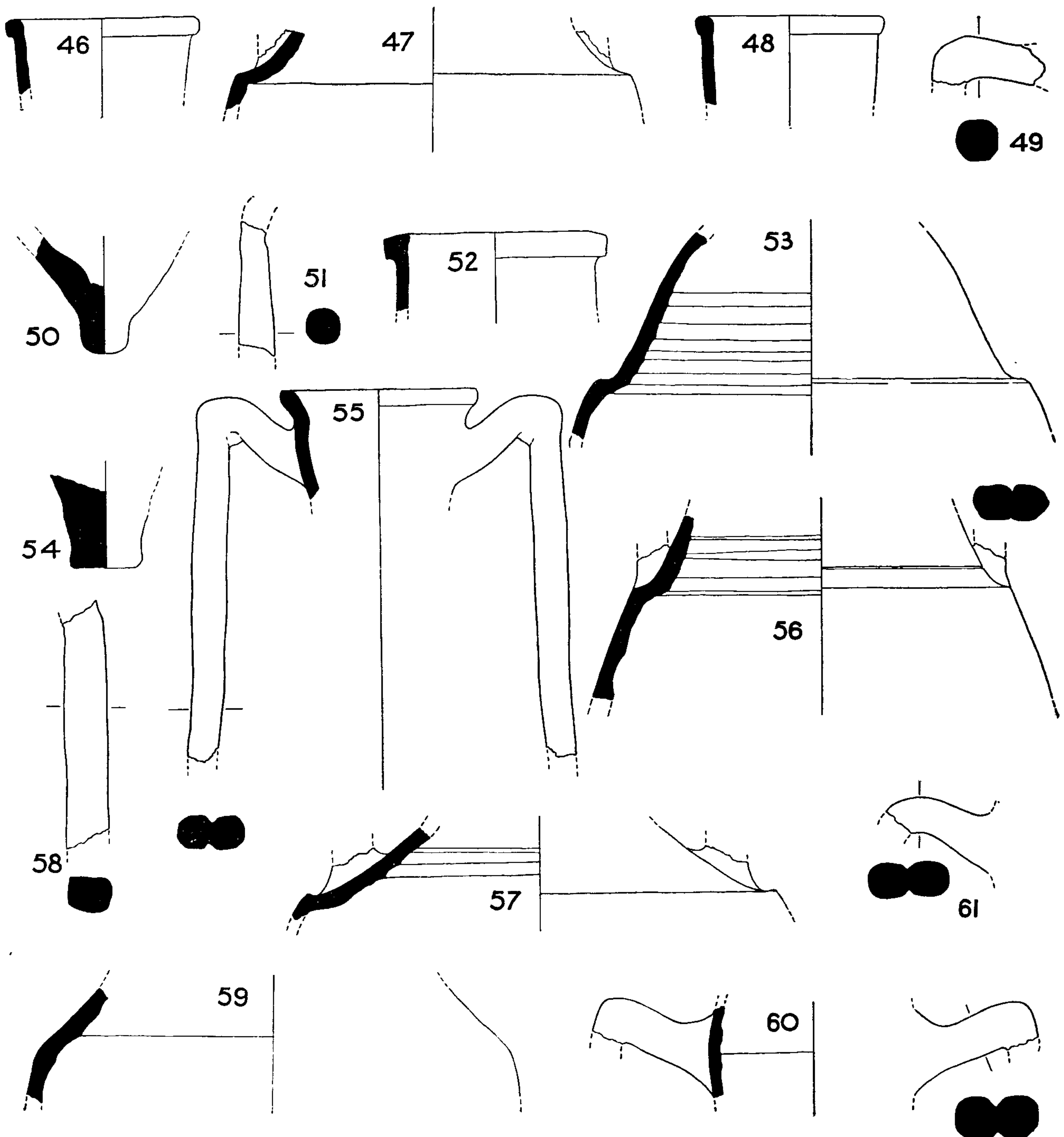


FIG. 9. *Imported amphorae from stratified layers, Northern Sector.* $\frac{1}{4}$

(a) Stratified amphorae from the Northern Sector

From pre-Arretine layers:

46. From AK II, stratum 14 (the lowest save one; 6 feet below present sea-level). Rim of pinkish buff ware.
47. Carinated shoulder, pink ware with yellow slip. From AK V, stratum 11A, underlying the wall of the 'warehouse' and equivalent to strata 13 and 14 on AK II.
48. Rim of yellow-slipped buff ware, same type as No. 46. From AK V, stratum 11, a pre-Arretine layer immediately below present sea-level.

From Arretine layers:

49. Fragment of handle of gritty pinkish buff ware from AK II, stratum 8A, which also contained a sherd of Arretine (above, p. 36).
50. Bluntly pointed base, of pink ware with yellow slip, from AK II, stratum 10A, which immediately overlay 8A.
51. Part of straight handle from AK II, stratum 7 Ar., which yielded most of the Arretine sherds from the site. Yellow ware.
52. From AK VIIIA, stratum 7, which equates with the Arretine-producing layer 7 Ar. of AK II. Pinkish buff ware with yellow slip.
53. Angular shoulder from AK VIII, stratum 5, which equates with the Arretine layer 7 Ar. of AK II. Pink ware.

From post-Arretine layers:

54. Bluntly pointed base from AK II, stratum 7H, contemporary with the construction of the 'warehouse'. Pink ware, yellow slip.
55. Rim and straight high-shouldered handle, of pink ware. From AK II, stratum 9, immediately overlying 7 Ar. and equivalent to 7H (No. 54). The straight, high-shouldered handle is characteristic of the first half of the first century A.D. (Loeschcke type 66, Ritterling type 73).
56. Angular shoulder, of pink ware with yellow slip. From the same stratum as No. 55.
57. Angular shoulder, pink ware with yellow slip, from AK II, stratum 7A, equivalent to that of Nos. 55 and 56.
58. Straight handle, pinkish ware with yellow slip, from AK II, stratum 7D, make-up of floor of 'warehouse'.
59. Bluntly carinated shoulder, pinkish ware with yellow slip. From AK II, stratum 6, make-up of floor of 'warehouse'.

60, 61. Short handles, pink ware with yellow slip, from AK V, Pit 1, subsequent to destruction of 'warehouse'. This stumpy type of handle is contemporary with the tall straight type, No. 55, but also long outlived it.

(b) Stratified amphorae from the Southern Sector (AK IV)

62. Rim, pink ware, from Pottery Group A (with sigillata base stamped ITTA), immediately underlying the earliest-but-one of the brick structures.
63. Angular shoulder, fine pinkish buff ware, dating from the beginning of the main 'Drain Period'.
64. Stumpy handle, pinkish buff ware, from the same layer as No. 63.
65. Fragment of straight handle, from a slightly later structure of the same phase as Nos. 63-4. Pink ware with yellow slip.
66. Pointed base, pink ware with yellow slip. Late 'Drain Period'.
67. Fragment of handle of gritty pink ware. Late Phase.
68. Fragment of handle of fine yellow clay. Late Phase.
69. Fragment of straight handle, gritty pink ware. Late Phase.

(c) From mixed deposits of the Northern Sector

70. Fragment of handle, pink ware with yellow slip. (AK II.)
71. Straight handle, pink ware. (AK II.)
72. Rim, buff ware. (AK II.)
73. Part of straight handle, pink ware with buff slip. (AK II.)
74. Rim, pink ware. (AK II.)

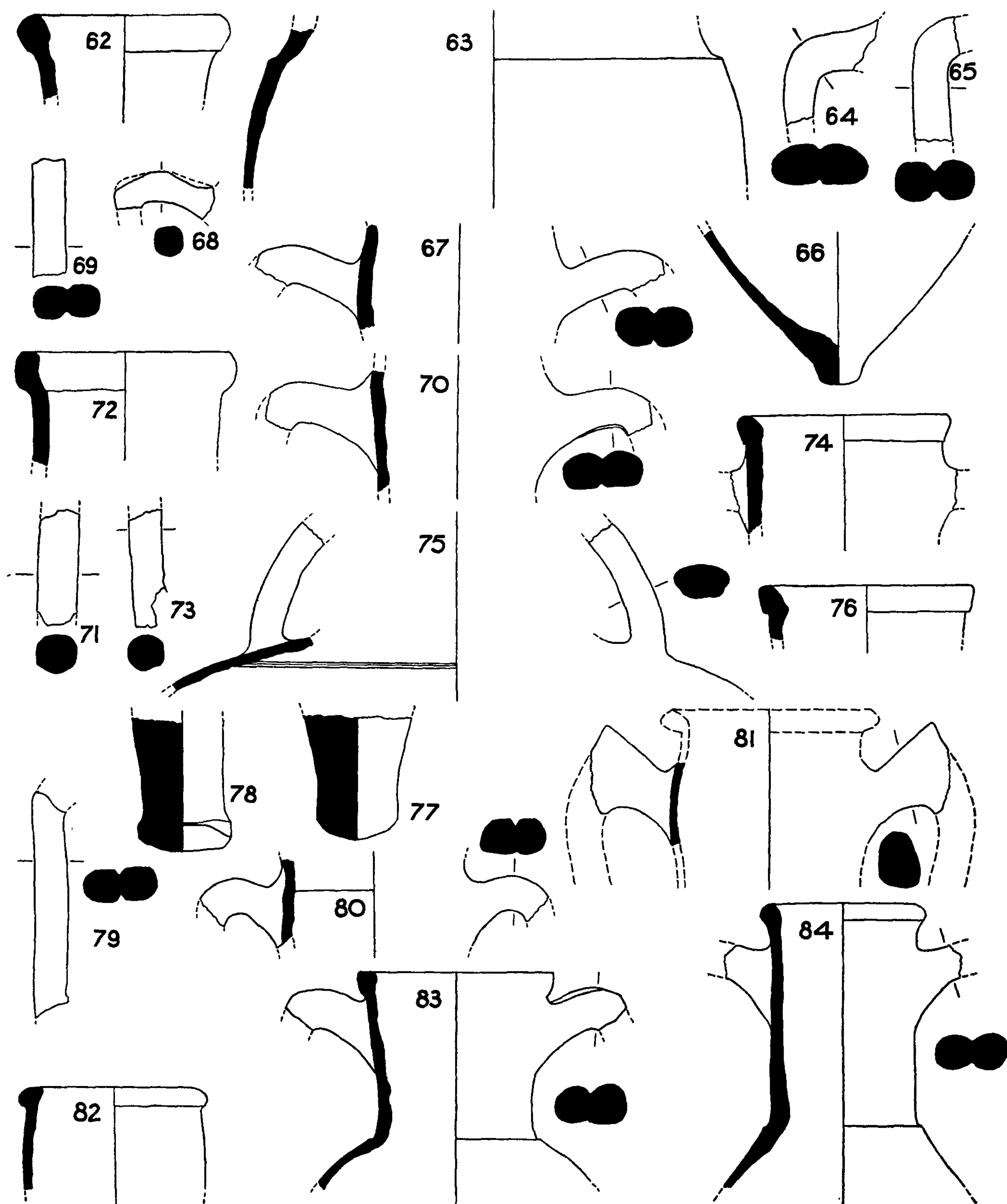


FIG. 10. *Imported amphorae : 62–69, from stratified layers, Southern Sector ; 70–84, from mixed layers.* ¼

75. Curved handle, fine pink ware with yellow slip. (AK VIII.)
76. Rim, pinkish ware with yellow slip. (AK VIII.)
77. Bluntly pointed base, pink ware with yellow slip. (AK VIII.)
78. Bluntly pointed base, pink ware. (AK VIII.)
79. Straight handle, pinkish ware with buff slip. (AK VII.)

(*d*) *From mixed deposits of the Southern Sector*

80. Fragment of handle, pink ware with yellow slip. (AK IV.)
81. Sharply shouldered handle, fine pinkish ware with yellow slip. This type of handle occurs at Haltern early in the first century A.D. and is found rarely at Hofheim towards the middle of the century. It is exceptional after A.D. 50. (AK IV.)
82. Rim of pink ware, traces of yellow slip. (AK IV.)

(*e*) *From the previous (French) excavations*

83-84. Necks of amphorae of light pink ware, 83 with buff slip.

Note: an amphora from Taxila

The only other Indian site known to have yielded an amphora of Mediterranean type is Taxila (Punjab), where an example (fig. 11) was found at a depth of 7 feet 4 inches in the Parthian city of Sirkap, and is dated by Sir John Marshall to the first centuries B.C.-A.D. Now in the Taxila Museum. Unlike the Arikamedu amphorae, which must represent maritime trade, the Taxila example is on general grounds more likely perhaps to have travelled overland from western Asia.

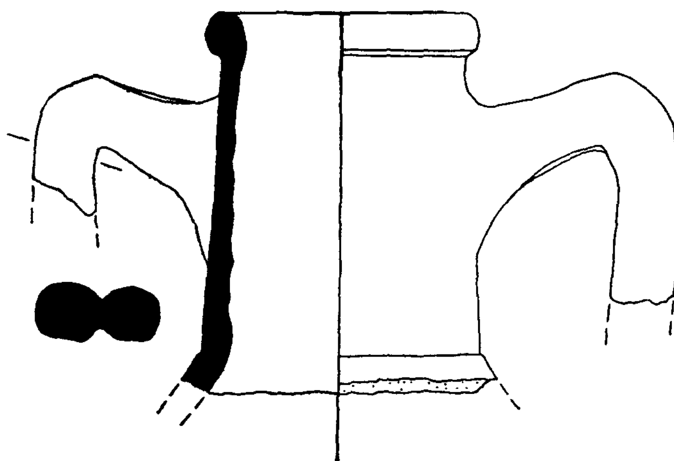


FIG. 11. *Imported amphora from Taxila, Punjab.* 1/3

(iii) *Rouletted black ware (Arikamedu Type 1)* [1]

A characteristic pottery-type of Arikamedu is a dish (Type 1) sometimes more than 12 inches in diameter, with an incurved and beaked rim which usually has a facetted edge. The ware has a remarkably smooth surface, is thin, brittle and well-burnt, and has an almost metallic ring. The flat interior is normally decorated with two, occasionally three, concentric bands of rouletted pattern (fig. 12 and pls. XXIIB, XXV, XXVI). This pattern is not an Indian feature and may be regarded as an importation from the Mediterranean region, but it has not yet been possible to ascertain whether the type itself is of similar origin. It may

[1] This and the following sections on the pottery are contributed by Mr. Krishna Deva.

in any case be presumed that the varieties with distinctly inferior fabric and degenerate rouletted pattern were manufactured locally.

Sherds of the rouletted black ware are present in all strata of all excavated sites at Arikamedu. Thus on AK II, which is the representative site of the Northern Sector, this ware occurs from the topmost to the lowest stratum, immediately overlying the natural soil, and thus appears to have come into vogue even earlier than the imported amphorae, which are found in all layers save the lowest. With this exception (which may be accidental, see p. 22), the ware is seen to be stratigraphically and chronologically co-extensive with the amphora, though it is found in much greater abundance. It both preceded and outlasted the Arretine ware by an appreciable margin. It is, however, noteworthy that the type is relatively more abundant in the pre-Arretine and Arretine layers of the Northern Sector, which signifies that the type became less popular after the middle of the first century A.D. Similarly, in the Southern Sector (AK IV) it is seen to be commoner in the earlier than in the later deposits. The first appearance of the rouletted pattern at Arikamedu is therefore as early as the end of the first century B.C. or beginning of the first century A.D., the approximate date of the lowest layers of AK II, while its terminal date is determined by the latest occupation in the Southern Sector of the town, attributable to *c.* A.D. 200.

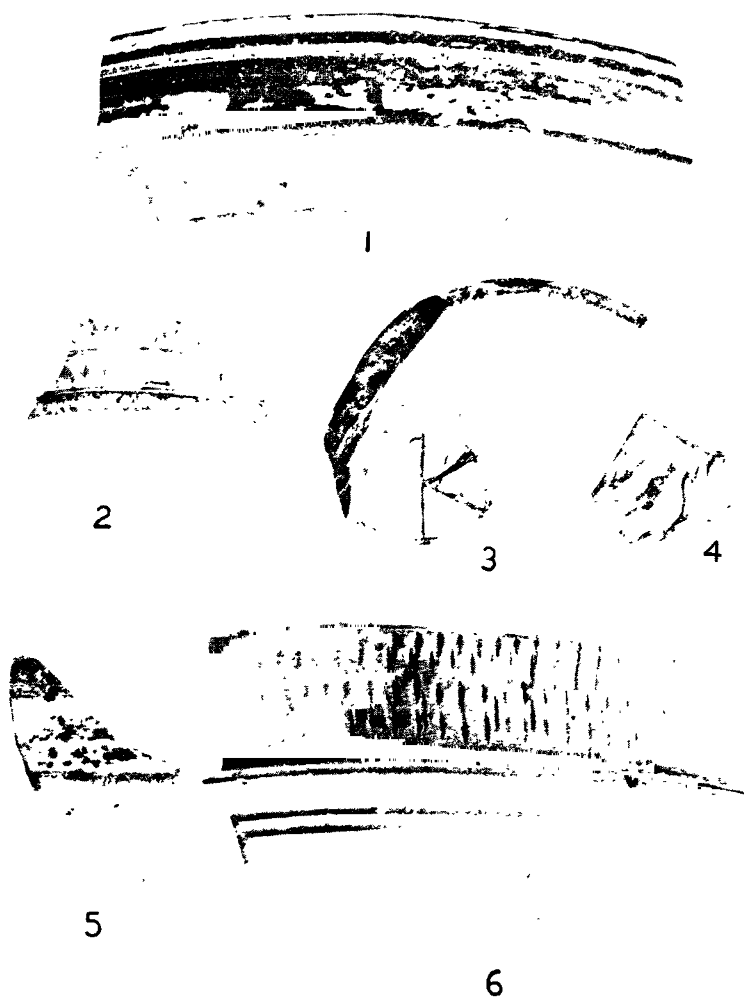
The ware was carefully potted on a quick wheel from a fine well-levigated clay which burned grey or, more often, greyish pink, the grey colour being due to the reducing condition under which the pot was fired. Before firing, it was usually treated inside and outside with a slip which, on being subjected to an inverted firing, turned black inside and showed variegated shades of grey, black, yellow or brown outside. Occasionally both faces are covered with black slip and rarely with brown. The different shades of the slip occur in the following order of frequency:—

1. Greyish pink ware, grey slip inside, brown to sepia outside.
2. ,, ,, ,, black ,, ,, brown outside.
3. Grey ware, black slip inside and out.
4. ,, ,, brown ,, ,, ,, ,,
5. ,, ,, black slip with magnetic lustre (below, p. 94).

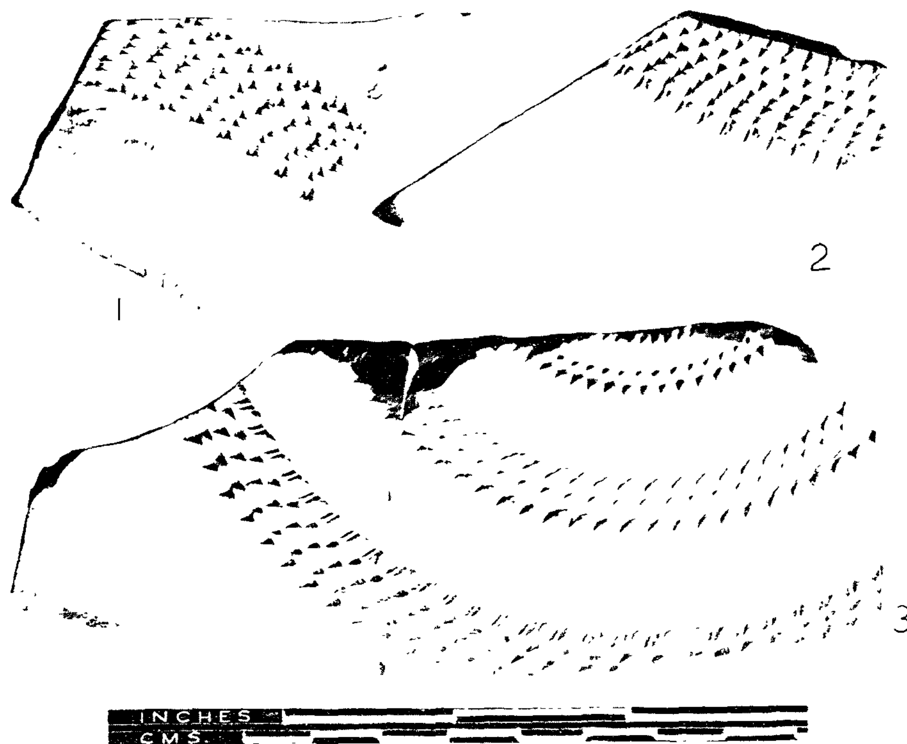
Of these, the first four are of universal occurrence, while the last is confined to the pre-Arretine layers of the Northern Sector with an overlap in the lowest Arretine-producing layer of AK II.

The interior surface was often burnished while the exterior seldom received this attention. In some cases the polish is high, though inferior to the lustre of the 'black polished pottery' of northern India (*Ancient India*, No. 1, 1946, p. 55). The specimens from the pre-Arretine strata are marked by a generally brighter polish than those from later deposits. The best-finished example of this type, with a remarkably high polish on *both* faces, comes from an early layer of AK V (Northern Sector) immediately underlying the south wall of the 'warehouse' and ascribable to the second quarter of the first century A.D.

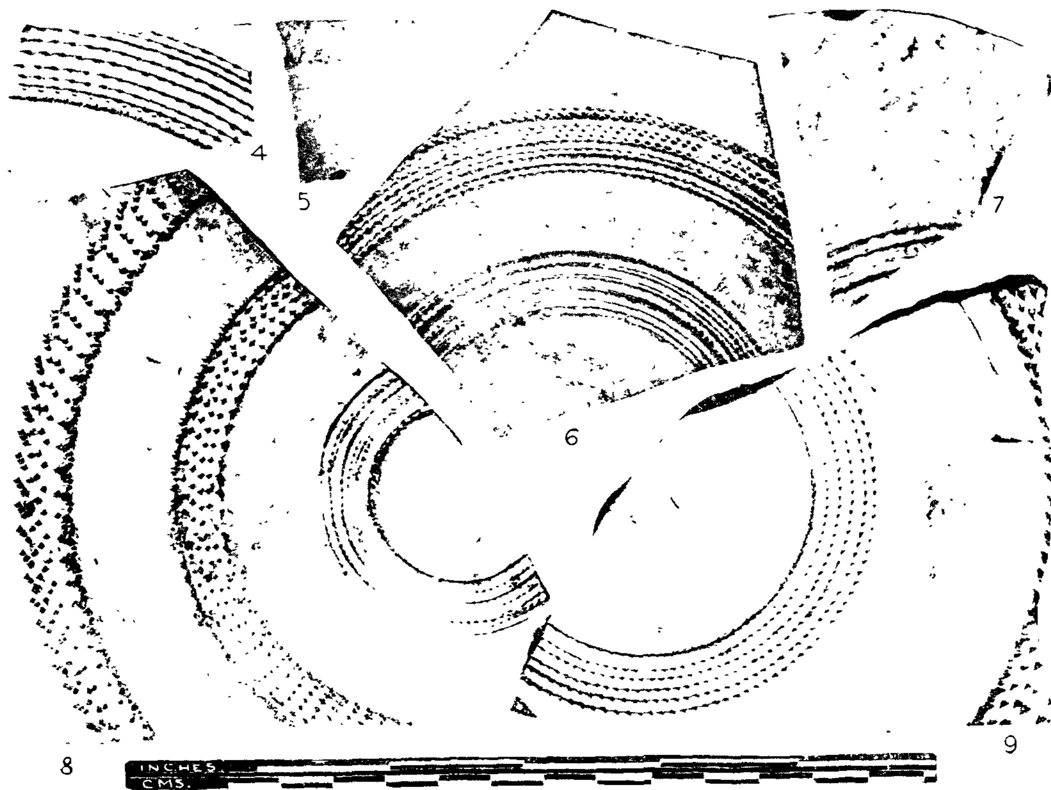
A few varieties of the main type may be distinguished by diversity of shape, fabric and rouletted design (fig. 12). 1*a* has a more incurved rim and is characteristic of the Early Phase (mid and late first century A.D.) of the Southern Sector, while 1*b* has the same form as 1 save for the external ribbings, which are absent in the pre-Arretine layers but are of occasional occurrence in later deposits. Variants 1*c-d*, distinguished by a very pronounced inward projection or beak, are confined to the pre-Arretine layers, although a blunter form, 1*e*, occurs rarely in these layers and survives occasionally (1*f-i*) throughout the occupation, associated sometimes with high external grooving. One or two of the latter were shallow bowls rather than dishes and may have lacked the internal rouletting.



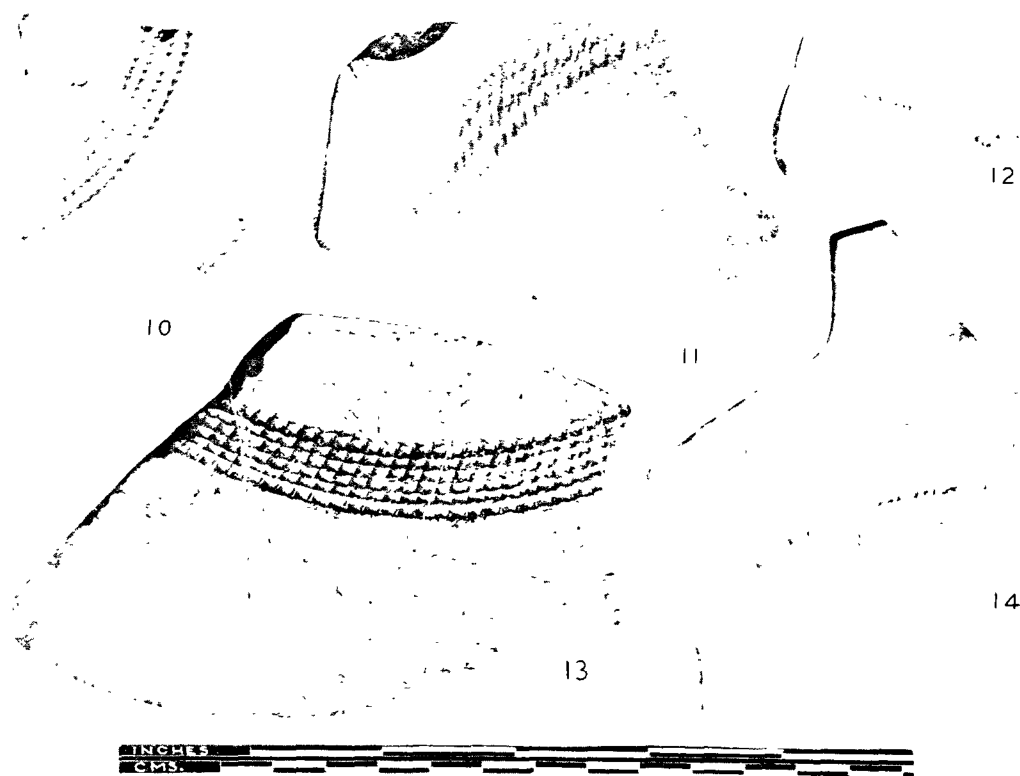
1–5, Arretine pottery ; 6, copy of Arretine form. $\frac{1}{1}$



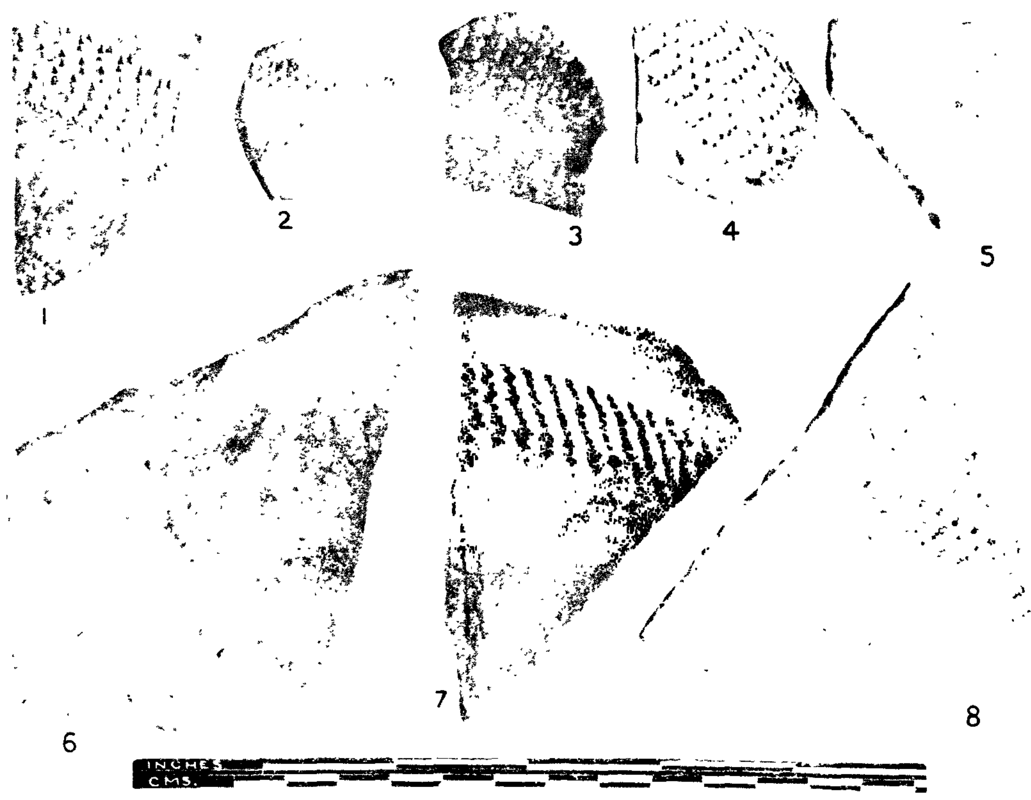
A. *Type 1, varieties of rouletting*



B. *Type 1, varieties of rouletting*



A. *Type 1, varieties of rouletting*



B. *Type 1, coarse rouletting*



A. *Rouletted ware: 1, from Chandravalli, Mysore; 2 and 3, from Amarāvatī*



B. *Base of pre-Arretine pot showing basket-impression*

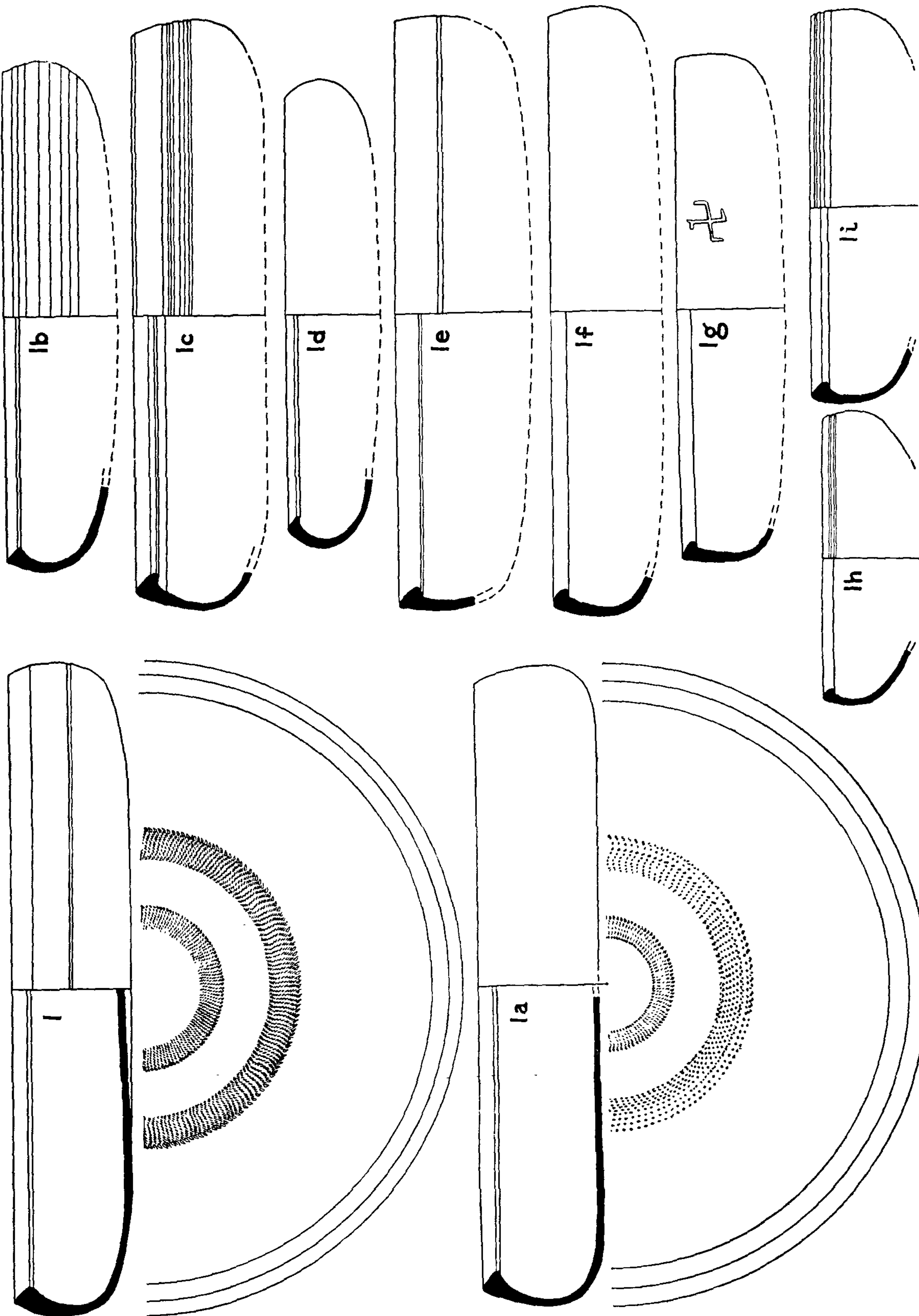


FIG. 12. *Type 1, rouletted ware.* $\frac{1}{3}$

The rouletting also shows a variety of forms (pls. XXV and XXVIA), consisting of minute triangles; diamonds or parallelograms; wedges or uprights; crescents; ovals or dots; or an eye-shaped device which is only an attenuated diamond. Of these, the triangles are the most common and occur in all strata. The other patterns also have a long vogue with the exception of the eye-shaped device (pl. XXVA), which is peculiar to the pre-Arretine layers of the Northern Sector, with an overlap in the lowest Arretine-producing layer of AK II.

Lastly, we may notice varieties of this type in an unmistakably inferior, usually thicker, fabric which is commonly left unslipped and unpolished. The rouletted pattern, too, shows deterioration on these varieties, which appear to have been locally manufactured. One variety, of a thick gritty blackish grey ware with shallow rouletted design (pl. XXVIB, 5), occurs only in the Southern (later) Sector. A solitary specimen from an Arretine level of the Northern Sector (AK V, 8N) shares all features of this variety but differs from it in having a polished black slip. Another variety consists of thick gritless grey ware with poor rouletting, and a third shows a scattered and rough rouletted pattern (pl. XXVIB, 2–4). It is significant that while these varieties are absent (with one exception from AK V just mentioned) from the pre-Arretine and Arretine layers of the Northern Sector and occur only sporadically in the later layers there, they are fairly common in the Southern Sector (AK IV) through all phases of its more prolonged occupation. There are also some rare examples of rouletted red wares of thick coarse fabric from AK IV (all periods), which are doubtless of local origin (pl. XXVIB, 6–8).

Elsewhere in India only three sites are at present known to have yielded sherds of rouletted black ware: Chandravalli and Brahmagiri (both Chitaldrug District), in the northern part of Mysore State; and Amarāvatī (Nellore District) in the Madras Presidency. The Chitaldrug sherds found in excavation have not been published but are preserved in the Museum of the State Archaeological Department at Mysore,[1] and others have been picked up on the two sites (pl. XXVIIA, 1). A sherd from Chandravalli is said to have been derived from a stratum which produced two denarii of Tiberius (A.D. 14–37) and two fragments of imported red-glazed ware of Arretine type. This is consistent with the Arikamedu dating. From the same site come fragments of dishes with bevelled rims also analogous to the Arikamedu type. These fragments include examples with yellow-painted patterns on a russet ground (fig. 13, i and ii)—a type of decoration widespread in southern India and now seen to be, at least in part, contemporary with the Arikamedu

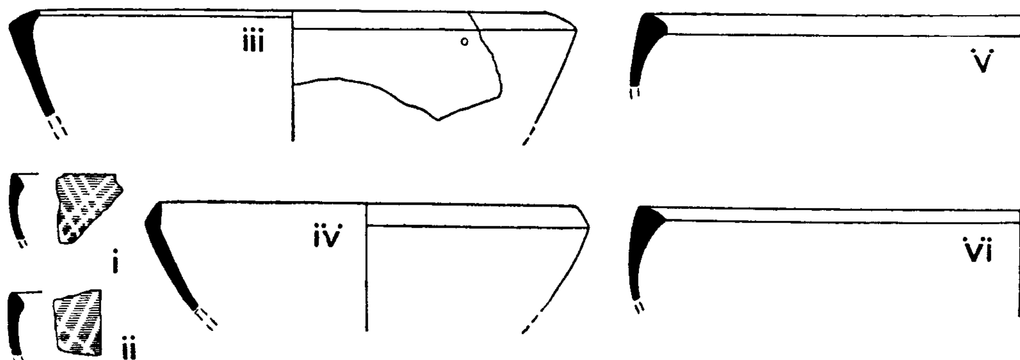


FIG. 13. *i-ii, from Chandravalli, Mysore State; iii-iv, from Bairāṭ, Jaipur State; v-vi, from Amarāvatī, Madras Presidency.* 1/3

[1] For a preliminary account of the Chandravalli excavations, see 'Excavations at Chandravalli', *Supplement to the Annual Report of the Mysore Archaeological Department for the year 1929* (Bangalore, 1931).

occupation. From Amarāvatī are derived two sherds of rouletted ware of Arikamedu Type 1, now in the Government Museum, Madras (pl. XXVIIA, 2 and 3), and rims of the same type have recently been picked up on the Amarāvatī town-site (fig. 13, v and vi).

In North India, in Jaipur State, a fragment of a dish with an inturned beaked rim generally approximating to the Arikamedu type and with a hard grey fabric and polished brown surface, also analogous, was found at Bairāṭ and is preserved in the Archaeological Museum at Jaipur (fig. 13, iii). The fragment is too small to indicate whether the base was rouletted, and this feature must not be assumed. The rim, unlike the Arikamedu type, is upturned, as is that of a further example of similar ware from Bairāṭ (fig. 13, iv).

For other resemblances between northern wares and those of Arikamedu, see p. 93.

The following are selected examples of Type 1 and its variants (fig. 12):—

1. Polished grey ware of fine fabric with black slip inside and on outer base, and light brown on outer rim. This is the arch-type. The specimen illustrated has, however, individual features in an inconspicuous external carination near the rim and a groove below, which runs less than half-way round the pot. Like a majority of the type, it bears two rows of fine rouletting. From a pre-Arretine layer (AK V, 11A); early first century A.D.

1*a*. Polished grey ware with pink patches on exterior and black-slipped interior, and two rings of rouletted pattern. Similar to 1 but with a more pronounced inward curve. From Pottery Group A, Early Phase of AK IV, containing an Arretine sherd stamped ITTA; mid first century A.D.

1*b*. Similar to 1 but with ribbings on the exterior. From the 'Arretine' horizon, AK V, 8N.

1*c*. Variety with unusually prominent beaked rim projecting inward, and a series of external grooves. Fabric as 1. From a pre-Arretine layer (AK V, 11A).

1*d*. Smaller and thinner variety of 1*c* with a more incurved side. Polished grey ware of fine fabric, greyish blue slip inside and on outer base, and light brown on exterior rim. From a pre-Arretine layer (AK V, 11A).

1*e*. Rim-fragment of polished greyish brown ware of fine-grained fabric with a blunt but prominent notched beak and external groove. From a pre-Arretine layer (AK II, 14).

1*f*. Fine grey ware, polished black slip inside and brown outside. From a layer containing Arretine ware (AK II, 11C); first half of first century A.D.

1*g*. Fine grey ware with pink patches. Shape similar to 1*f*. Traces of greyish black slip. A *svastika* cut on the outside after firing. From the Late Phase of AK IV; probably second century A.D.

1*h*. Similar but slightly inferior ware, black internally and brown externally, with blunt beak and high external grooving. This example represents a small bowl rather than a dish, and may not have had internal rouletting. From Pottery Group A on AK IV; approximately mid first century A.D.

1*i*. Similar ware to 1*a*. Blunt beak and high external grooving; former presence of internal rouletting uncertain. From Southern Sector, 'Main Drain' Period, first-second century A.D.

B. Local wares

Introductory note

Previous sections of this report have dealt mainly with imported wares or motifs. But by far the greater mass of the Arikamedu pottery consisted of local wares, to which the imported material now for the first time gives an approximate chronology.

With a few exceptions, the local pottery was turned on the wheel. The exceptions include a class of portable ovens, rings of 'ring-wells', some large troughs and storage jars, and conical jars of Type 75, the last being partly wheel-turned and partly hand-made. The normal dégraissants are sand and grit, but mica and straw or husk are occasionally used for this purpose. The fabric was usually a porous clay containing a fair amount of sand, which burned pink or greyish red to light red under oxidizing conditions of firing and dull grey to greyish black under reducing conditions in the kiln. For a special class of grey or greyish pink wares a superior quality of clay, free from grit and remarkably fine-grained, was employed. Slips are fairly common, and a fair percentage of the pottery was either

salt-glazed (below, p. 93) or treated with a burnished slip. The vast majority of the types are plain and utilitarian in character. Decorated types are rare, and decoration is generally simple and primitive in character, the commonest being finger-tip ornament.

A small percentage of Arikamedu pottery was subjected to inverted firing, i.e. was placed upside-down in the kiln with a fair quantity of carbonaceous matter stuffed inside. As a result of this firing, the whole of the interior and the portion of the exterior (usually the rim) which came into direct contact with the fuel turned jet black, and the remaining outer surface became red under oxidizing conditions and grey under reducing conditions in the kiln. For the sake of brevity we shall refer to the former as black-and-red ware and the latter as black-and-grey ware. The effect was strikingly picturesque if the pots were treated with a slip and salt-glazed (below, p. 93) in course of firing, a feature which is characteristic specially of the 'Arretine' period of the Northern Sector (first half of first century A.D.).

For purposes of classification, the local pottery is divisible into two broad groups, the first coming from the Northern Sector and the second from the Southern. The wares from the earliest layers of the Northern Sector are predominantly grey, with a sprinkling of red wares mostly painted with haematite or bright red slip. In later deposits of this Sector there was a progressive increase in the quantity of red ware, until it assumes parity with the grey and finally outnumbers the latter as the top layers are reached. In the Southern Sector, the occupation of which began later and lasted later, a crude type of pottery overwhelmingly red in colour is predominant. Though many types of the Northern Sector are present here, some new varieties of familiar types and a number of altogether new types are in evidence; whilst the fabric, even in the earliest layers, is generally inferior to that of the Northern Sector, and becomes increasingly degenerate towards the top layers. The conclusion is that the pottery of the Southern Sector represents in the main a continued process of devolution already incipient in the later layers of the Northern Sector. The occasional introduction of new types in the Southern Sector seems to indicate, however, that other influences were at work alongside the normal processes of evolution or devolution.

For the convenience of study, the local pottery and other finds from Arikamedu may be divided into the following chronological classes, corresponding with the stratigraphical evidence:—

A. *Northern Sector* (first century A.D.):

(1) 'Pre-Arretine', i.e. finds from the layers underlying those which yielded Arretine pottery and ascribable to the end of the first century B.C. or the beginning of the first century A.D. ;

(2) 'Arretine', i.e. finds from the layers yielding Arretine pottery, and other equivalent layers of the first half of the first century A.D. (mainly *c.* A.D. 20–50) ;

(3) 'Post-Arretine', i.e. finds from all the upper layers, which in the absence of any significant sub-division will be dealt with together. They are of the mid or late first century A.D.

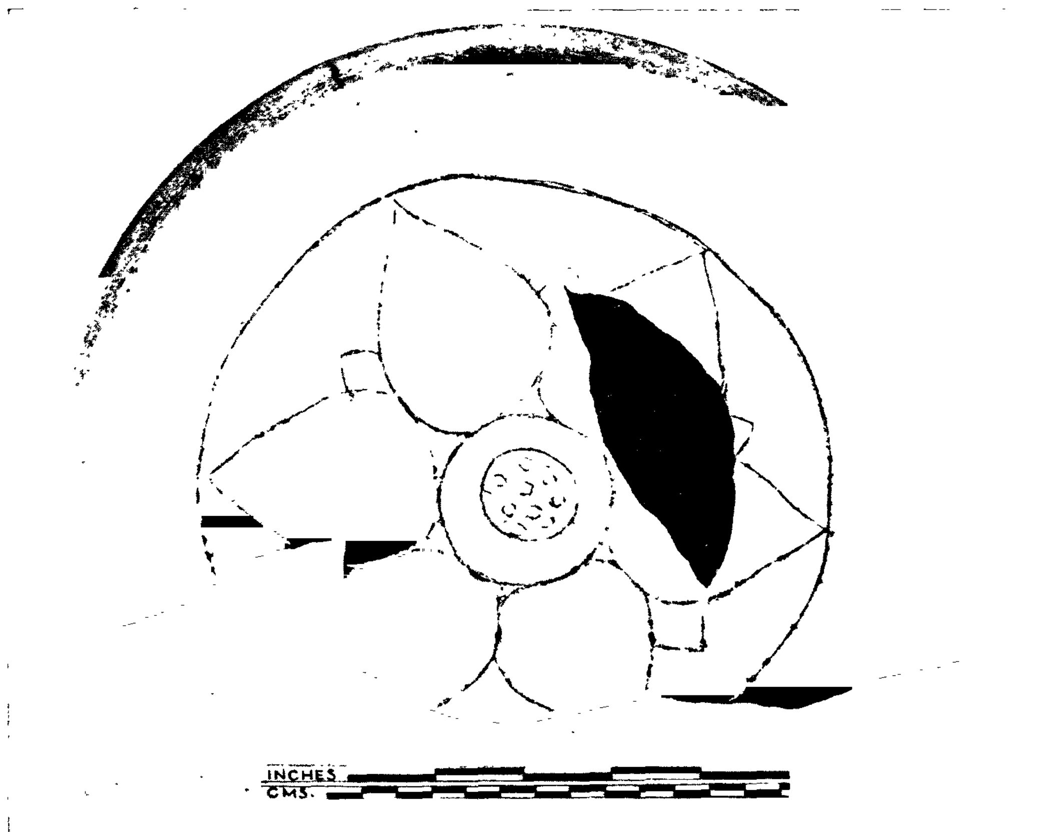
B. *Southern Sector*, mostly AK IV (mid first-second century A.D.):

(1) 'Pre-structural', shortly before the middle of the first century A.D. ;

(2) 'Early Phase', mid or late first century A.D. ;

(3) 'Main Drain Period', i.e. finds contemporary with the elaborate system of drains and connected walls of Middle Phase, sub-period 1; first-second century A.D. ;

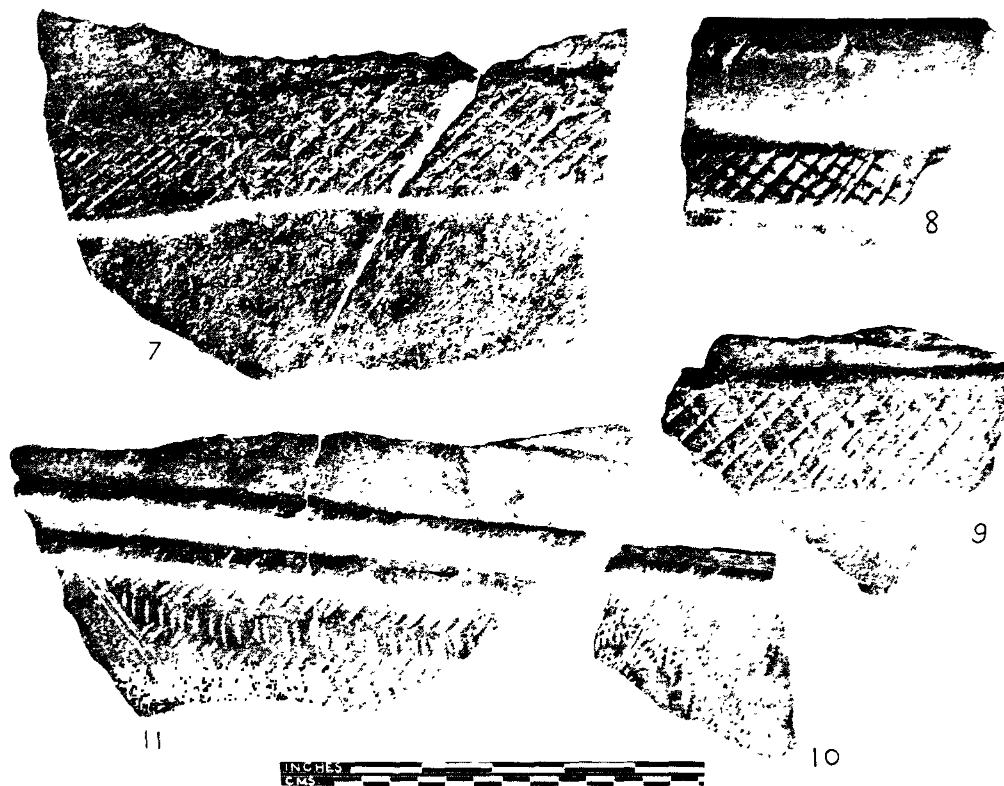
(4) 'Late Drain Period', i.e. finds contemporary with the additions and restorations to the main drain and other connected walls of Middle Phase, sub-periods 2 and 3; second century A.D. ;



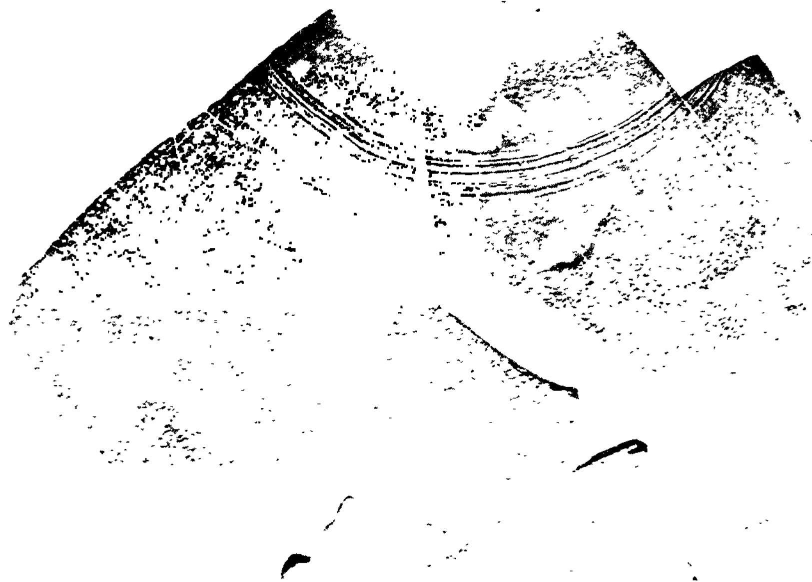
A. *Type 6, base showing basket-impression and graffito decoration*



B. *Decorated sherds from pre-Arretine layers*



A. *Decorated sherds from pre-Arretine layers*





B. *Decorated sherd from pre-Arretine layers*



A. *Decorated sherds from Arretine layers*



B. *Decorated sherds from Southern Sector, Pre-structural Phase*



A. *Graffito ; Southern Sector, Middle Phase.* $\frac{1}{1}$



B. *Pre-Arretine sherd, Northern Sector.* $\frac{1}{1}$











C. *Painted and incised sherds ; Southern Sector, Early Phase.* $\frac{3}{4}$



A. *Post-Arretine sherd; Northern Sector.* $\frac{1}{1}$



B. *Decorated sherds; Southern Sector, Late Drain Phase*

(5) 'Late Phase', i.e. finds belonging to a period when the earlier structures were entirely discarded and their place was taken by a few isolated and fragmentary walls here and there; second century A.D., or later.

A(1). *Pre-Arretine (late first century B.C. or early first century A.D.).*—The pre-Arretine or earliest group of pottery from Arikamedu comes from the lowest layers of the Northern Sector which are now submerged from 2 feet to 10 feet below mean sea-level. The pottery from the following layers are included in this group:—

AK II (A–P) { layer 12 (underlying the lowest Arretine layer).
„ 13
„ 14
„ 15 (overlying the natural soil).

AK II (I–X)—layer 12.

AK V { layer 9N = 11.
„ 10N = 11A. (These layers are equivalent respectively to 13 and 14 of AK II.)

The pottery from these early layers is predominantly grey and of a coarse to medium fabric, usually treated with a greyish chalky slip which is not infrequently polished or salt-glazed. The only exception occurs in the lowest layer of AK II which has yielded more red than grey ware, but, as little pottery of any kind was found in this layer, which presumably represents the old foreshore, the exception cannot be stressed.

The distinctive feature of this group is the occasional use of a bluish chalky slip, which is absent on pottery from later deposits. It occurs on a fair number of common grey-ware pots belonging to Types 3, 4, 8, 9, 11, 21, 24, 28, 30, 31, 43, 48, 59, 74, 93 and 101. Analysis shows that the chalky matter consists of an aqueous suspension of kaolin, while the bluish shade is due to traces of ferrous oxide.[1]

Salt-glazed bowls of Types 9, 9*d* and 9*h–m* of a polished black-and-grey fabric are also characteristic of this group. Another feature peculiar to it is a black slip with magnetic lustre (magnetic oxide of iron) which occurs occasionally on Types 1, 2 and 9 (below, p. 94). A majority of the characteristic types of Arikamedu are already present in this group. These include Types 1–4, 8–12, 21, 22, 24, 25, 28, 30, 31, 34, 42–45, 48, 54, 55, 59, 60, 70, 72, 74–76, 82–84, 87-88, 93, 97 and 101.

Ornamentation is rare on the pre-Arretine wares and comprises, besides finger-tip ornament, simple incised and applied designs and patterns impressed deliberately or accidentally from mats or baskets (pls. XXVIIB and XXVIIIB, 4-5). A black-and-red ware dish of Type 6 is remarkable for the mat-impressions on its exterior base, which is further embellished with a lotus design incised after baking (fig. 15, Type 6; pl. XXVIIIA). Other devices are: a row of oblique wedge-shaped slashes on a fragmentary vessel of buff ware (pl. XXXIB); incised herring-bone patterns on a number of storage jars (pl. XXIXA, 1-2; 10-11); incised zig-zags on the neck of a basin (pl. XXVIIIB, 3); raised bands with cross-hatched pattern on storage jars and basins (fig. 30, Types 83 and 83*b*; pl. XXIXA, 7–9); and indentations within incised horizontal and vertical grooves (pl. XXIXB).

A(2). *Contemporary with Arretine* (*c.* A.D. 20–50).—The pottery contemporary with the Arretine wares is distinguished from the pre-Arretine groups by the absence of the markedly bluish chalky slip, the only exceptions occurring occasionally in the lowest Arretine-producing layer (AK II, 8 green), which yielded eleven sherds with this slip. Of these, six belong to Type 9, four to Type 8 and one to Type 9*h* as against fifteen, thirty-four and nil respectively with other varieties of slip from the same stratum. Other overlaps from the previous groups consist of two examples of black slip with magnetic lustre (below, p. 94) and two fragments of polished black-and-grey ware bowls of Type 9*h*. These overlaps confirm the general continuity of culture on the site.

The pottery of the Arretine phase, like that of the pre-Arretine, is predominantly of a coarse grey fabric and is usually treated with greyish (not bluish) chalky slip which is often salt-glazed (below, p. 93) or polished. A trend is, however, noticeable towards a gradual increase in the frequency of *red* ware throughout the phase, until we find the red and grey ware in approximately equal quantities in the latest Arretine-producing strata.

Many types survived from the preceding period into this, but some new forms such as Types 18, 18*a*, 49, 61, 69 and 73 were introduced now for the first time.

Mottled ware is also peculiar to this group. A small number of slipped and salt-glazed pots of Types 4, 8 and 24 exhibit patches of pink colour variegated with greenish grey, with striking effect. On a dish of Type 8

[1] Information from the Chemist, Archaeological Survey of India.

occurs an irregular scaly design in greenish line on a background of salt-glazed chalky slip. It is, however, difficult to ascertain whether the mottling was merely accidental or deliberate.

Black (as distinct from dark grey) ware is represented in this period by half-a-dozen specimens belonging to Types 8, 9 and 43, as against a solitary example in the pre-Arretine group.

Ornamented pottery is even rarer in the Arretine phase than in the pre-Arretine. Of painted decoration there is a single fragmentary specimen, too minute for illustration, showing faint bands in black on a light red ground. Of incised ornament, the most noteworthy is the *svastika* scratched after baking on two fragmentary bowls of Type 9 (pl. XXXA, 2-3). A variety of basket-impression is an innovation of this period (pl. XXX, 1). All other patterns are survivals from the preceding phase.

A(3). *Post-Arretine (second half of first century A.D.)*.—In the post-Arretine period of the Northern Sector the principal types and fabrics remained substantially the same as in the preceding periods. The only difference occurs in the relative incidence of the red and grey wares, of which the former now becomes predominant, thus indicating a change in technique. The muffled kiln, or firing under reducing conditions, appears to have lost favour with the potter of the post-Arretine period, who developed a growing fondness for the open kiln or firing under oxidizing conditions.

Another change in this period consisted of a diminution of the vogue for burnishing and salt-glazing.

Such utilitarian devices as spouts and handles are now in greater evidence, though they are still far from common. Spouts and lug-handles, of which there are two varieties, are innovations of this period, and are continued in the Southern Sector.

New forms introduced in this period were Types 5, 8*q*, 8*x–w*, 9*f-g*, 29, 32, 33, 38, 41, 53, 71, 78, 80*a*, 113 and 116.

Some of the old types undergo a slight modification in this period or produce new varieties. Thus we get, besides the normal form, a thicker variety of Type 9*w* in red ware with a roughly finished surface on which no care has been taken to obliterate the corrugations produced by the wheel. This new variety continues in the Southern Sector and gets progressively more degenerate there. Further, a highly burnished variety of Type 4, with a distinct ware and fabric, is peculiar to this period.

Haematite slip is rare in this as in the Arretine class and occurs only on a few sherds of Types 9*h-i* and 42.

Most of the decorative motifs of the preceding periods survived in this phase. The only innovation is a stamped design of rosettes occurring on a red-ware fragment (pl. XXXIIA).

B(1)–(5). *Pottery from the Southern Sector (late first-second century A.D.)*.—The two sites excavated in the Southern Sector, AK I and IV, both showed extensive disturbance at the hands of brick-robbers, and only AK IV produced significant layers (above, p. 26).

This Sector represents an essentially red-ware culture which contrasts with the grey-ware culture of the Northern Sector. As we have seen (p. 50), the transition from grey to red ware was achieved by slow stages, which were all traversed in the Northern Sector, so that the monopoly of red ware in the Southern Sector does not indicate a cultural intrusion there. The essential continuity of the two Sectors is corroborated by the survival of most of the characteristic types of the Northern into this Sector. In the latter the pottery tends to degenerate in course of time, becoming progressively coarser and more devoid of slip in the upper levels. The retrograde tendency is noticeable as early as the Early Phase and becomes a regular feature of the later wares from the Late Drain Period onwards.

Towards the close of sub-period 1 of the Early Phase a large heap of pottery was dumped in a sealed pit and is called 'Pottery Group A'. This Group contained an Arretine bowl stamped ITTA (above, p. 40), half-a-dozen pieces of imported amphora, the base of a pot bearing a Prākrit graffito, and a large number of familiar types with variants.

Ornamentation is as scarce in this Sector as in the Northern, and is indistinguishable from it. From the Pre-structural Phase of this Sector, three sherds bear incised criss-cross patterns (pl. XXXB, 2–4); two are decorated with oblique slashes (pl. XXXB, 5); the base of a grey-ware bowl is stamped on the interior with a row of lotus petals comparable with those on fig. 36, Type 141 (pl. XXXB, 1); while a rouletted sherd (Type 1) bears a graffito of lotus stalks (pl. XXXB, 6). From the Early Phase comes a small carinated vessel of thin fabric, decorated with slanting rows of dots in white paint on a red-slipped surface (pl. XXXIC, 1). Another sherd, of Type 8, bears deep slashes on the interior (pl. XXXIC, 5). Mat-impressions are still frequent (pl. XXXIC, 2–4).

To the Main Drain Period belongs a sherd bearing a graffito of a double *svastika* (pl. XXXIA).

The decorated sherds from the Late Drain Phase include a fine grey-ware bowl stamped on the interior of the base with conventional lotus petals similar to Type 141 (fig. 36, pl. XXXIIB, 3); a jar-fragment bearing incised palm-leaf pattern (pl. XXXIIB, 1) and a sherd with criss-cross pattern (pl. XXXIIB, 2).

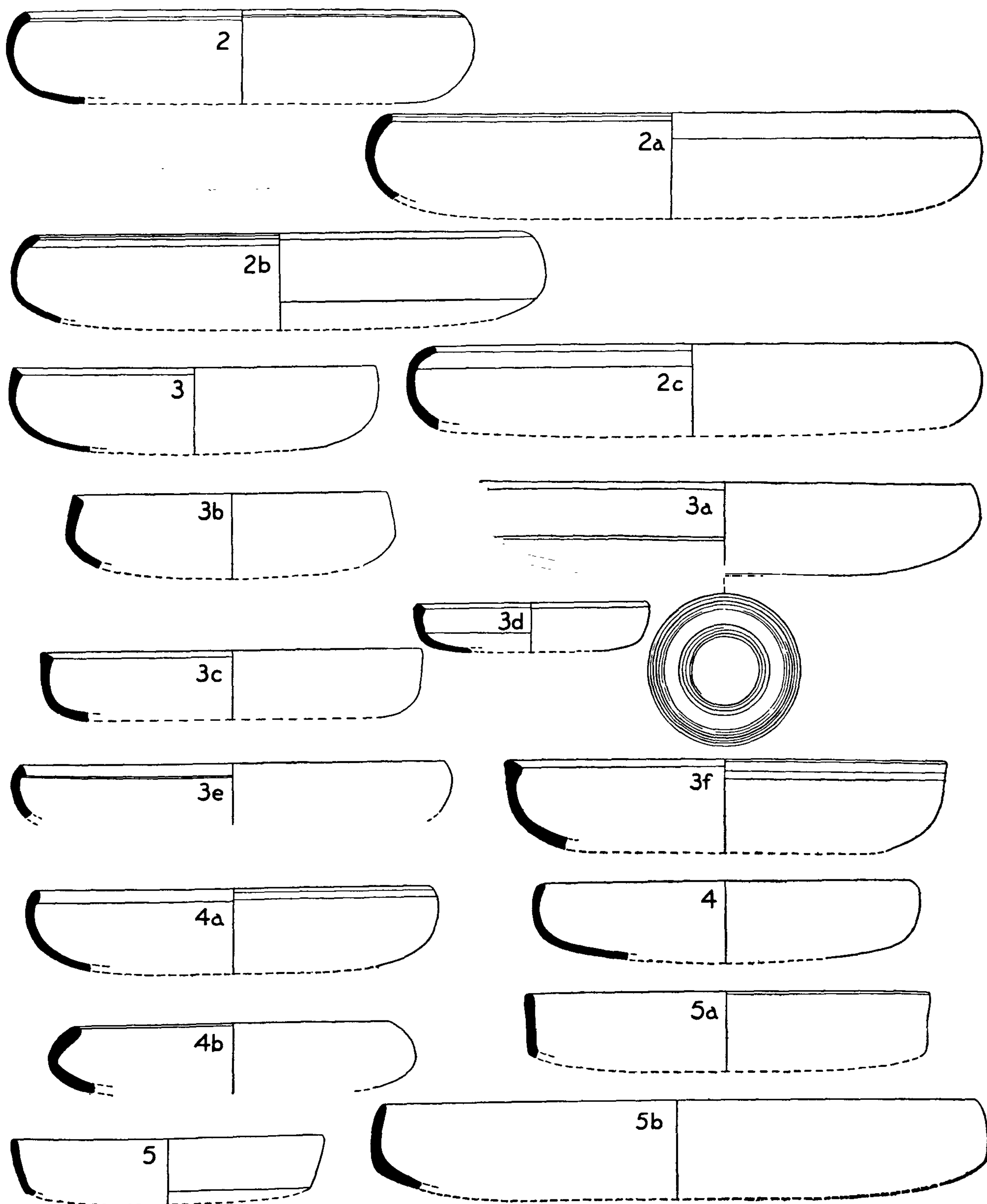


FIG. 14. *Types 2–5.* ¼

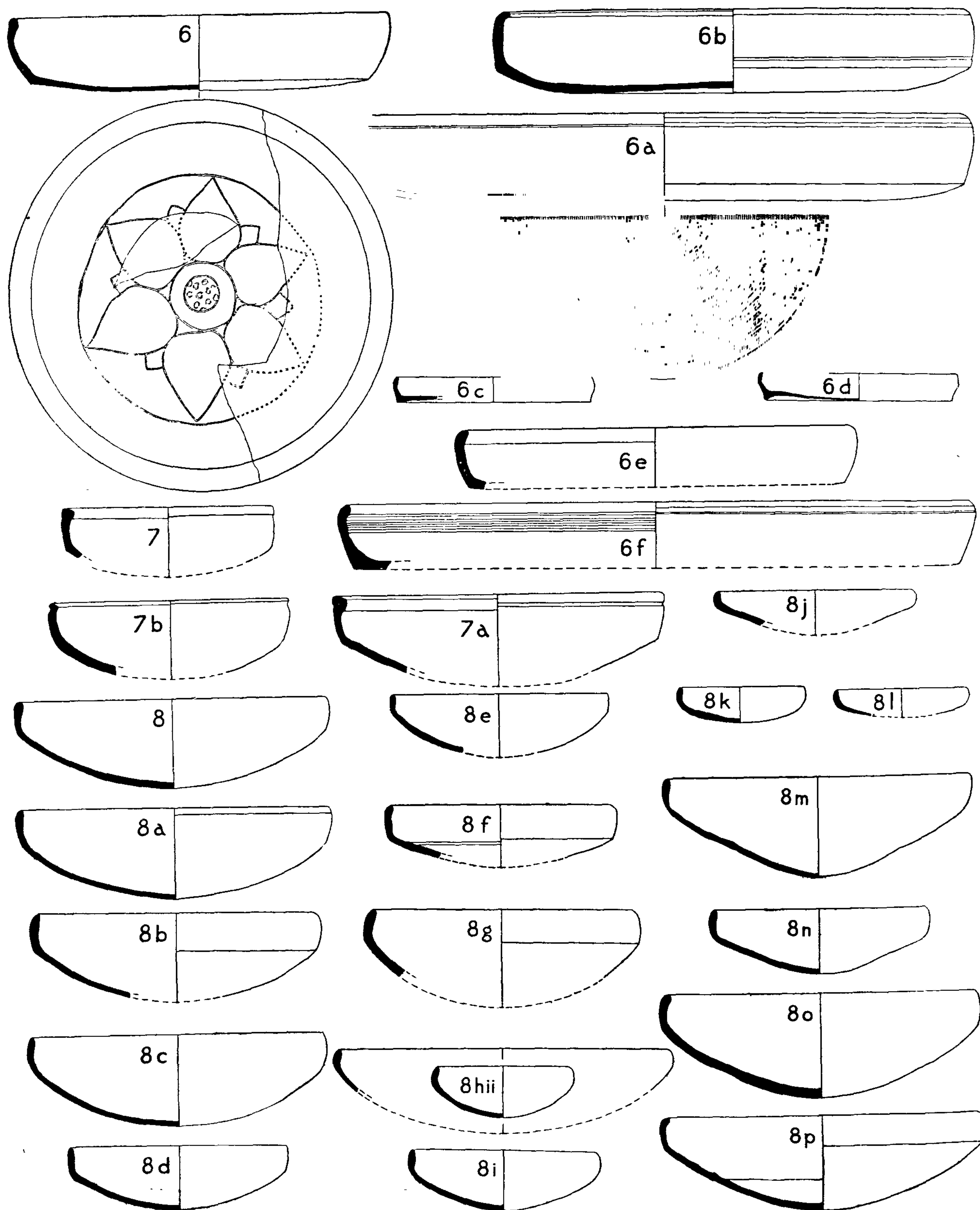


FIG. 15. *Types 6–8.* ¼

It may be added that a number of superficial and disturbed layers yielded sherds of Chinese celadon ware, evidently deposited during the spoliation of the site in the middle ages (below, p. 91).

Types 2–148

Type 2 is a dish identical in fabric with Type 1 (p. 46) but lacking the inward projection or beak at the rim. Like Type 1, it has a sharply incurved side and the lip is usually facetted at the edge, but, unlike Type 1, it constitutes one of the minor types of the site. The arch-type and the variant *2a* with a slightly thicker rim are occasionally found throughout the occupation of both Sectors, though they are relatively more abundant in the pre-Arretine and Arretine layers of the Northern Sector. Variant *2b*, with a thinner and more pronouncedly incurved side and a larger number of facets at the rim, is peculiar to the pre-Arretine layers. Though of a markedly coarser fabric, variant *2c* shares all the other features of the type, including its polished surface; it is confined to the post-Arretine strata of the Northern Sector.

Type 3 is a dish with a beaked rim similar to Type 1 but, like the majority of the local types, is of an inferior and coarser fabric; also it is invariably devoid of rouletted decoration. This is another of the minor types of the site, though it is found in all periods of the two Sectors. Variant *3a* deviates from the main type in the decoration of the inside of the base with rows of roughly incised concentric circles. This feature is peculiar to the pre-Arretine and Arretine layers. Variant *3b*, with an almost carinated profile, is a unique specimen from an Arretine stratum (AK VIII, 5). Variants *3c*, *3d* and *3f*, which are invariably grey wares, belong to the pre-Arretine strata; while *3e* occurs occasionally from the pre-Arretine period to the Late Phase of AK IV, exclusively in red ware.

Type 4 is a simple dish with an incurved rim and a rounded base and, amongst dish-forms, is next to Type 1 in frequency. This type is of similar fabric to Type 3, and occurs in a variety of colours such as grey, red, black-and-red, or black-and-grey, due to differential firing. Variant *4a*, having an internally clubbed rim, is a unique pot from a mixed group (AK VIII, pit 1), while *4b* with a sharply incurved side is remarkable as much for its shape as for its whitish fabric. Only two examples of the latter are known, both from the Late Phase of the Southern Sector.

Type 5 is a carinated dish with an almost straight side and is of the same coarse fabric as Type 3. This is a very rare type and does not occur earlier than the post-Arretine period in the Northern Sector and the Early Phase in the Southern. Variant *5a* differs from Type 5 in having a slightly concave profile, while *5b* is a dish of finer grey fabric peculiar to the Early Phase of AK IV, including Pottery Group A.

Type 6 is a rare dish with an incurved rim and flattened sagger base. The arch-type comes from the pre-Arretine layers and is only found in black-and-red ware of coarse fabric. The specimen illustrated has, however, individual features in being decorated with mat-impressions (pl. XXVIIIA) over the exterior of the base, which is embellished with a large lotus flower incised after baking. Variants *6a-b* are grey wares occurring exclusively in the pre-Arretine layers and are even rarer than the main type. Variant *6a*, with a lip thinner than the arch-type, is incised with numerous concentric grooves on the interior of the base, while *6b* is distinguished by a slightly concave base. Variants *6c-d* are unique miniature dishes of fine grey ware (the former from 'Pottery Group A', i.e. Early Phase, and the latter from the Main Drain Phase of the Southern Sector), which have similar profile as *6a* but show a pronouncedly concave base. Variants *6e-f* are thicker grey-ware dishes of fine-grained fabric, and occur at all periods in the Northern Sector and in the Pre-structural and Early Phases of the Southern Sector.

Type 7, a dish with a rounded base, is distinguished by a clubbed and externally grooved rim. Variant *7a* is larger in size and has a deeper groove than the main type, while *7b* has a smaller rim and more rounded profile. The type is extremely rare and belongs to the post-Arretine period, while its variants come from the Main Drain Phase of the Southern Sector. The arch-type is of coarse greyish buff ware, black inside and on outer rim, and greyish buff on the exterior of the base. Variant *7a* is of black-and-red ware of coarse fabric. Variant *7b* is of greyish buff ware of a fine-grained fabric with grey core and smoothed buff-slipped surface inside and out.

Type 8 is a dish distinguished by a sagger base and constitutes one of the most characteristic types of Arikamedu. It is of a coarse fabric and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern and all periods of the Southern Sector. Some of the grey examples are salt-glazed (see below, p. 93). Though it was primarily a dish, some pots of this type may also have been used as lids. The arch-type and all its variants save *8f-g*, *8j*, *8l* and *8q–z* are found in abundance from the earliest to the latest occupation of both Sectors. Variants *8a–e* and the miniature variety *8k* have a similar base to the arch-type but differ from it in rim-form. Variants *8f* and *8l* are peculiar to the Arretine layers of the Northern Sector, while *8g* and *8j* are confined to the pre-Arretine layers. Variants *8h-i* form a class by themselves by reason of their distinctive sharpened rim-form. Similarly variants *8m–p* constitute a homogeneous group in

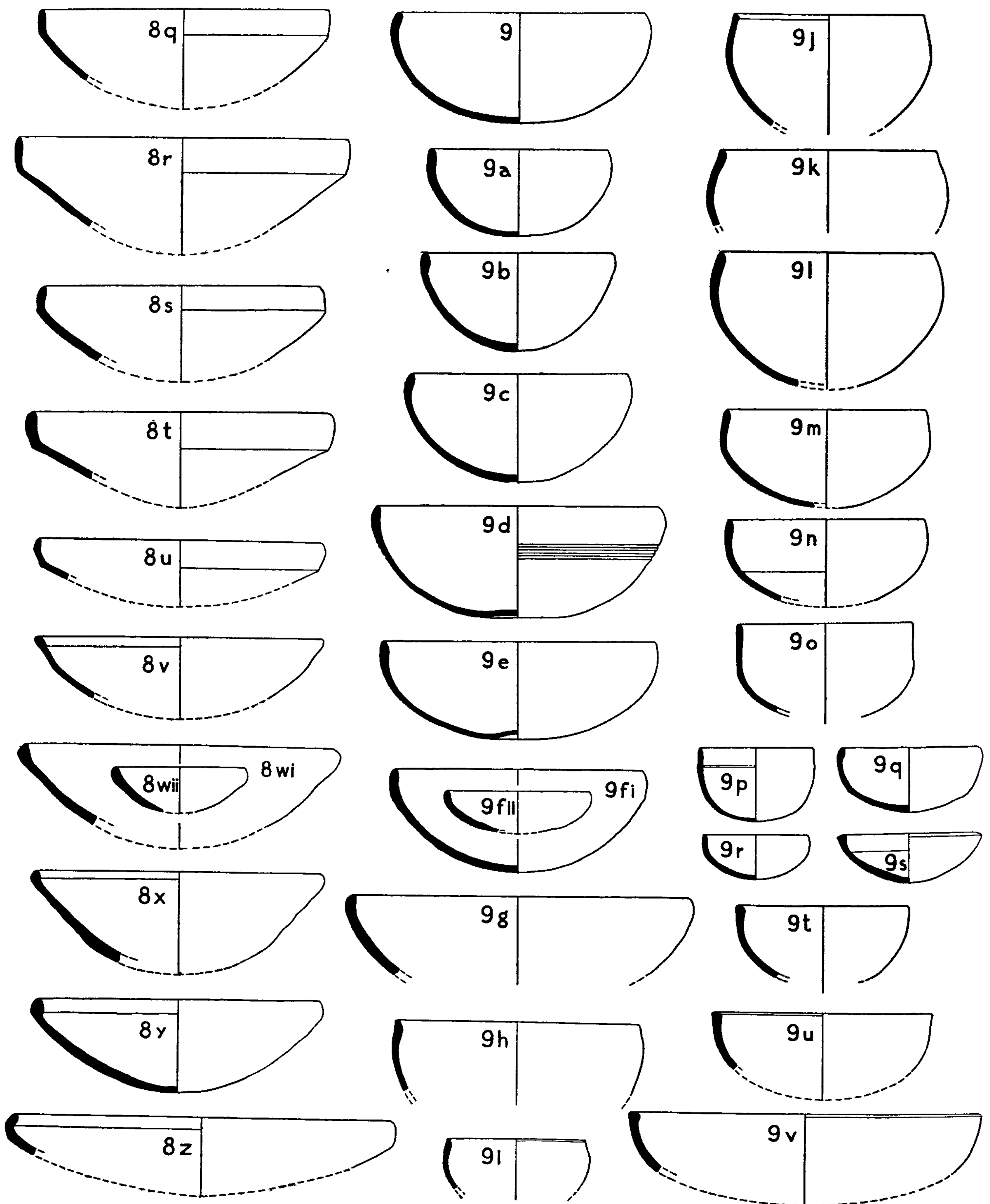


FIG. 16. *Types 8 (continued)-9.* ¼

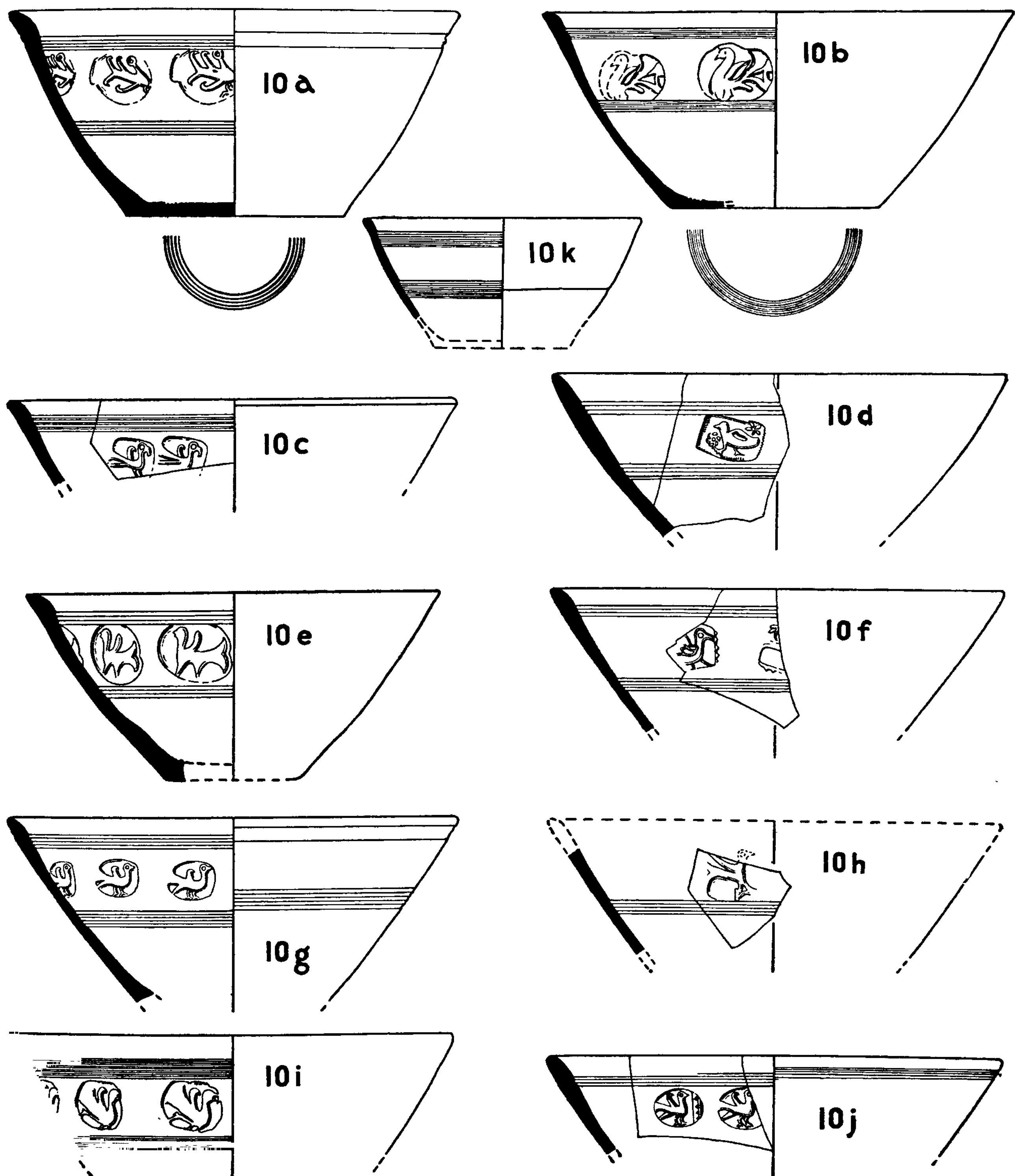


FIG. 17. *Type 10.* ½

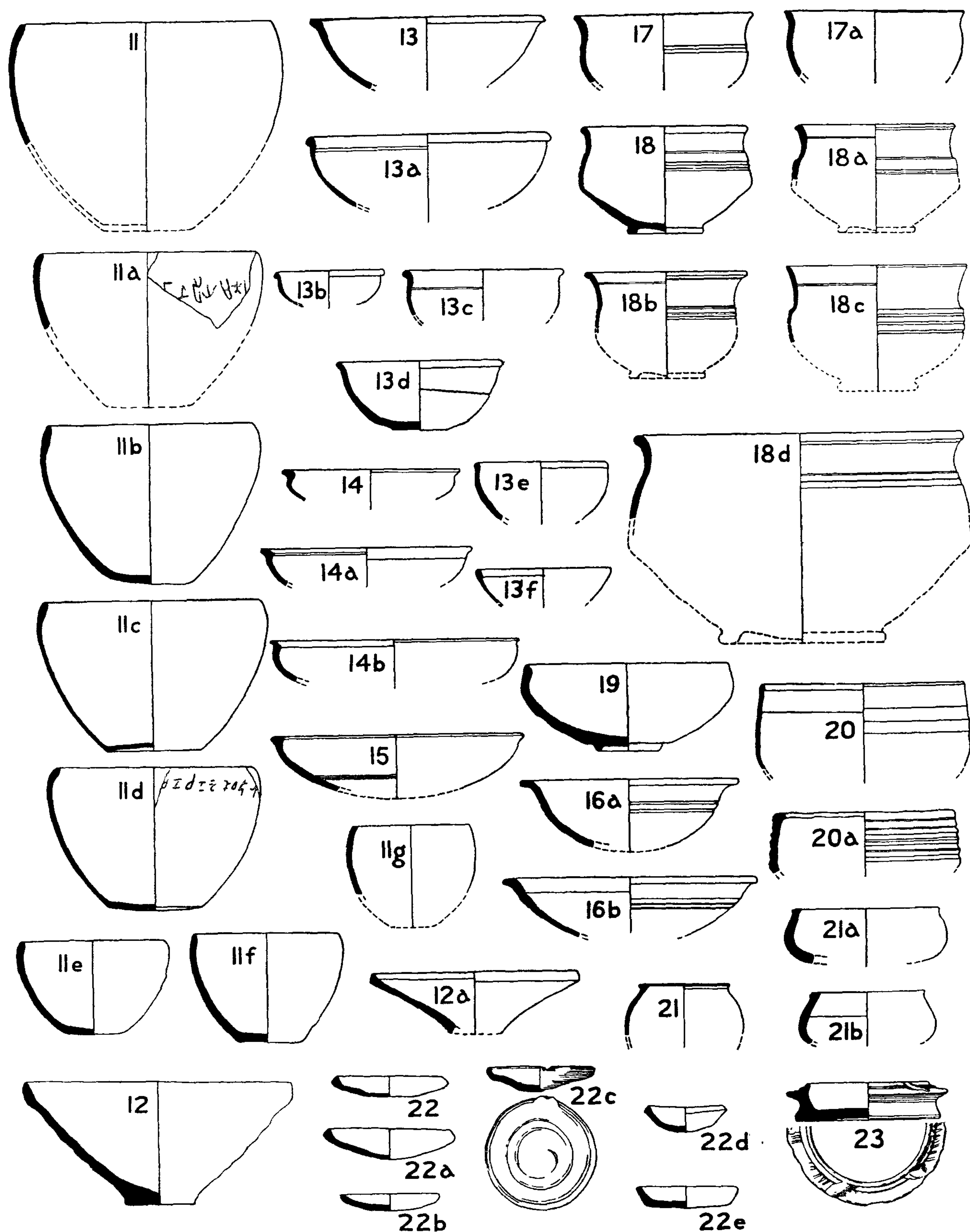


FIG. 18. *Types 11–23.* ¼

the pronounced sag of their base. Again, variants 8*q-u* have a sharp carination as their common characteristic, while 8*w-x*, with roughly finished corrugated surface, belong to a separate sub-group which is characteristic of the later phases of the Southern Sector, though it starts in the post-Arretine period of the Northern. Some of the variants differ in their distribution. Thus 8*q* is found in the post-Arretine layers of the Northern Sector and throughout the occupation in the Southern, while 8*s–u* are confined to the post-Arretine period of the Northern Sector; 8*z* to Pottery Group A (Early Phase) of AK IV; 8*v* and 8*r* to the Early Phase and Main Drain Period of AK IV; and 8*y*, with an internally beaded rim, to the Late Phase of AK IV. A remarkable feature of variant 8*v* is that it is usually found in black-and-red ware, while a unique specimen of this in a smaller size occurs in the lowest Arretine-producing layer (AK II, 8 green) in polished black-and-grey ware.

Type 9 is a simple bowl with a rounded base and constitutes one of the major types of Arikamedu. It is of a coarse fabric and is generally grey (sometimes salt-glazed) in the pre-Arretine and Arretine layers, but is normally red in the post-Arretine period of the Northern Sector and is always red in the Southern Sector. It is invariably treated with slip both inside and out. Variants 9*a–c*, which are found throughout the occupation of both Sectors, slightly deviate from the arch-type in the form of the rim. Variant 9*a* has a thick and nearly straight rim, while 9*b* has an internally thickened rim, and 9*c* a similar but sharper one. Variant 9*d* is a unique bowl from the Main Drain Phase of AK IV with grooves below the rim and a slightly concave base, while 9*e*, from a pre-Arretine stratum (AK II, layer 13), resembles the arch-type in all respects save the base, which is markedly concave or omphaloid. Variants 9*f-g* are thicker wares with roughly finished surface on which no care has been taken to obliterate the corrugations produced by the wheel. These are characteristic of all phases of the Southern Sector, though they also occur occasionally in the Northern Sector, particularly in the post-Arretine period. Variants 9*h–l*, with pointed rims having a concave profile, form a group by themselves and, in addition to the standard grey and red colours, occasionally occur also in black-and-grey (confined to the pre-Arretine layers) and black-and-red.

While 9*h-i* and 9*k* are found in all periods of the Northern Sector and from the Pre-structural to the Main Drain Phase in the Southern Sector, the deeper bowls 9*j* and 9*l* are confined to the pre-Arretine layers of the Northern Sector. Variants 9*m–o* have taller sides, but, while 9*m* is peculiar to the pre-Arretine layers, 9*n-o* occur exclusively in the Arretine layers of the Northern Sector. Variant 9*p* is a unique little bowl from the Late Phase of AK IV, while 9*r* represents the tiny bowls which frequently occur throughout the occupation of both Sectors, usually in coarse grey or red ware and occasionally in fine greyish pink ware. Variants 9*q* (coarse grey ware) and 9*s* are unique bowls from the post-Arretine layers of the Northern Sector, while 9*t–v* having rims, with a slight inward projection form a distinctive sub-group. Of the latter, 9*u* is represented by only three examples of which two, with bluish slip, come from the pre-Arretine layers and one in black-and-grey ware from a post-Arretine layer of AK II, while 9*t* in black-and-grey ware and 9*v* in common red ware are unique and belong respectively to an Arretine and a post-Arretine layer of the Northern Sector.

Type 10 represents a special form of cup or small bowl of grey, greyish pink or black-and-red ware of fine fabric, usually with a black slip inside and pink outside. It has a flat base and tapering profile, and is ornamented on the interior of the sides with a row of stamped medallions between two bands of multiple incised grooves, with a further band of concentric grooves on the inside of the base. The medallions represent fish or birds, including apparently the peacock. This is one of the characteristic shapes of the site and is occasionally found throughout the occupation of both Sectors. The only piece without stamped decoration is 10*k* (from the lowest Arretine layer of AK II), which is also the smallest example and may have been left unstamped as being too thin to bear the impact of the stamp.

Type 11 is a tall bowl with an incurved rim and a flat base. This is one of the principal types of the site and is found in fair abundance throughout the occupation of both Sectors. It is of a coarse fabric and is generally grey (sometimes salt-glazed) in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all periods of the Southern. It is usually treated with slip both inside and out. The arch-type is found in varying sizes of which the largest is illustrated. The next in popularity is 11*a* which slightly deviates from the main type in the form of the rim. The specimen illustrated bears a graffito inscription (see p. 111). Variants 11*b* and 11*d* (the latter also with a graffito) have sharply incurved rims and are very common in the pre-Arretine layers, though they are occasionally found in all periods of both Sectors. Variant 11*c* is a unique specimen from a pre-Arretine stratum (AK V, 9N) in that it has a concave base. Variant 11*e* from a pre-Arretine stratum (AK II, 14) is a small thick-walled bowl with a corrugated exterior, while 11*f* from the Main Drain Phase of the Southern Sector is another small thick bowl with a slight concavity at the base. The last variant, 11*g*, with a flat-topped rim, is from an Arretine stratum (AK VIII, 5).

Type 12 is a bowl with a wide mouth and small flat base and is distinguished by a corrugated tapering body. This type occurs throughout the occupation of both Sectors, but is relatively rare in the Northern Sector. It is of a coarse fabric, usually devoid of slip, and is generally grey in the pre-Arretine and Arretine layers and greyish red in the post-Arretine period of the Northern Sector and all phases of the Southern. Variant 12*a* is an extremely rare type characterized by an oblique-edged rim and slightly concave tapering sides. It is of a coarse grey or greyish buff fabric and occurs only in the pre-Arretine and Arretine layers of the Northern Sector.

Type 13 is a grey-ware bowl of fine fabric with an externally beaded rim. This is an extremely rare type, the arch-type being represented by only three examples, all from the Southern Sector, and the variants by a single specimen each. One example of the arch-type comes from Pottery Group A (Early Phase), the second from a later layer of the Early Phase and the last from the Late Phase of AK IV. Both 13*a* and 13*b*—the latter a very small example—are greyish pink wares of fine fabric, from the Arretine horizon (AK VIII, 5; AK II, 8A). Variant 13*c* from a post-Arretine layer and 13*d* from a pre-Arretine stratum (AK II, 14) are deeper bowls of fine grey ware, the latter having a flat base and an inconspicuously beaded rim. Variant 13*e* is a deep red-ware bowl from the Pre-structural Phase of the Southern Sector, while 13*f* from a mixed group (AK VIII, pit 1) is also red ware but, unlike other examples of this type, has an internally beaded rim.

Type 14 is a shallow bowl with an everted rim and is another rare type. The arch-type is peculiar to the Arretine layers of the Northern Sector, while 14*a* and 14*b* are unique variants in fine grey ware, respectively from an Arretine stratum (AK II, 11C) and from Pottery Group A (Early Phase) of the Southern Sector.

Type 15 is represented by a unique example. It has a rounded base and convex rim, and is of a light black-and-red ware. It comes from an Arretine stratum (AK II, 7 Ar.).

Type 16 is a bowl distinguished by a flaring rim. It is represented by only two examples, of which 16*a* is coarse black-and-red ware from an unstratified deposit (AK I) of the Southern Sector, while 16*b* is of a greyish buff fabric with polished black slip inside from the post-Arretine Phase of the Northern Sector.

Type 17, a bowl with a flaring rim, is a rare type in polished black-and-grey ware and is confined to the Arretine layers of the Northern Sector. Variant 17*a* is a unique specimen in fine grey ware from Pottery Group A (Early Phase) of the Southern Sector. The shape of the bases of these bowls is unknown.

Type 18 represents a special class of fine grey or pinkish grey bowls of thin and well-burnt fabric. It is distinguished by a beaded rim, carinated waist and foot-ring, and has a grooved shoulder. It is noteworthy both for its rarity and for its careful potting. It is absent from the pre-Arretine layers of the Northern Sector and from the Late Phase of the Southern, but occasionally occurs in the Arretine and post-Arretine layers of the Northern Sector and in the Pre-structural to the Late Drain Phase of the Southern Sector. Variants 18*b* and 18*c* are unique examples, the former being from a mixed group (AK VIII, pit 1) and the latter from the unstratified French excavations; while 18*d*, which is nearly double the size, is peculiar to the post-Arretine period of the Northern Sector.

Type 19 is a unique bowl combining the profile of Type 9 with the foot-ring of Type 18. It is of a thick coarse greyish red fabric, and comes from the Main Drain Phase of the Southern Sector.

Type 20 is another rare type, representing a series of corrugated bowls which come exclusively from the Southern Sector. The main type is of thin black-and-red ware from the Pre-structural Phase, while variant 20*a* is a thicker greyish buff ware with an inturned rim from the Early Phase of AK IV. The shape of the bases of these bowls is unknown.

Type 21 is a tiny globular bowl with a beaked and flattened rim. This is one of the minor characteristic types of the site and is occasionally found throughout the occupation of both Sectors. It is of a coarse fabric and is generally grey in the pre-Arretine and Arretine layers and red both in the post-Arretine period of the Northern Sector and in all periods of the Southern. Variants 21*a-b*, in coarse greyish red ware, are thicker and squatter than the arch-type and occur exclusively in Pottery Group A (Early Phase) of the Southern Sector. The shape of the bases of these bowls is unknown.

Type 22 is a lamp. It is characteristic of the site and occurs throughout the occupation of both Sectors. It is of a coarse fabric and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all periods of the Southern. Variant 22*a* is of a larger and relatively less popular size; while 22*b* is a shallow red-ware lamp peculiar to the Late Drain Phase. Variant 22*c*, distinguished by a pinched soot-stained lip, is a rare variant, confined to the Late Phase of the Southern Sector. Variants 22*d* and 22*e* are solitary examples respectively from the Main Drain Phase of the Southern Sector and an Arretine layer (AK II, 7 Ar.) of the Northern.

Type 23 is a unique lamp with a flanged collar which is ornamented with slanting applied ridges and incised strokes. It is of coarse greyish black ware, and comes from a mixed group (AK VII, pit 2A) which yielded an

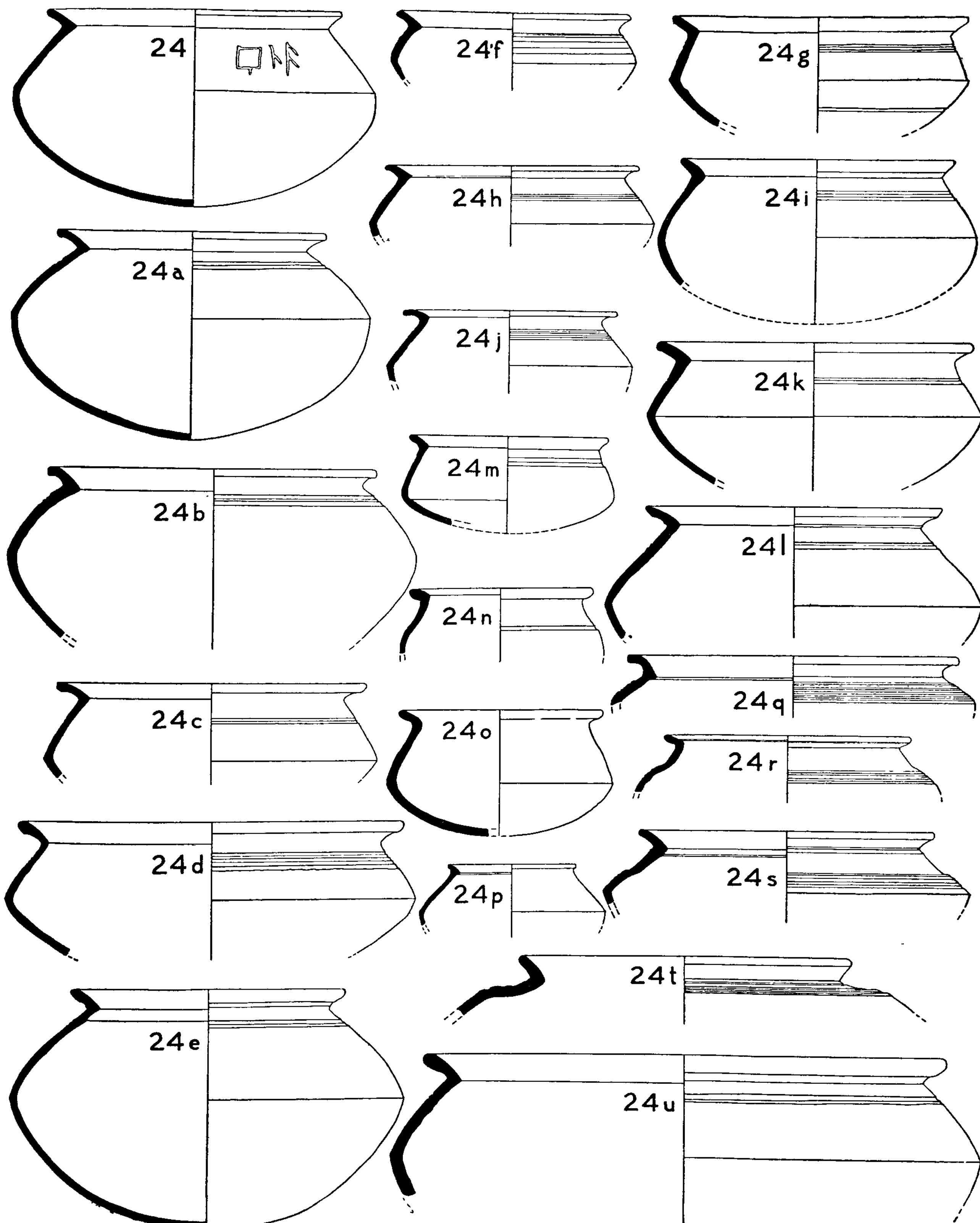


FIG. 19. *Type 24.* ¼

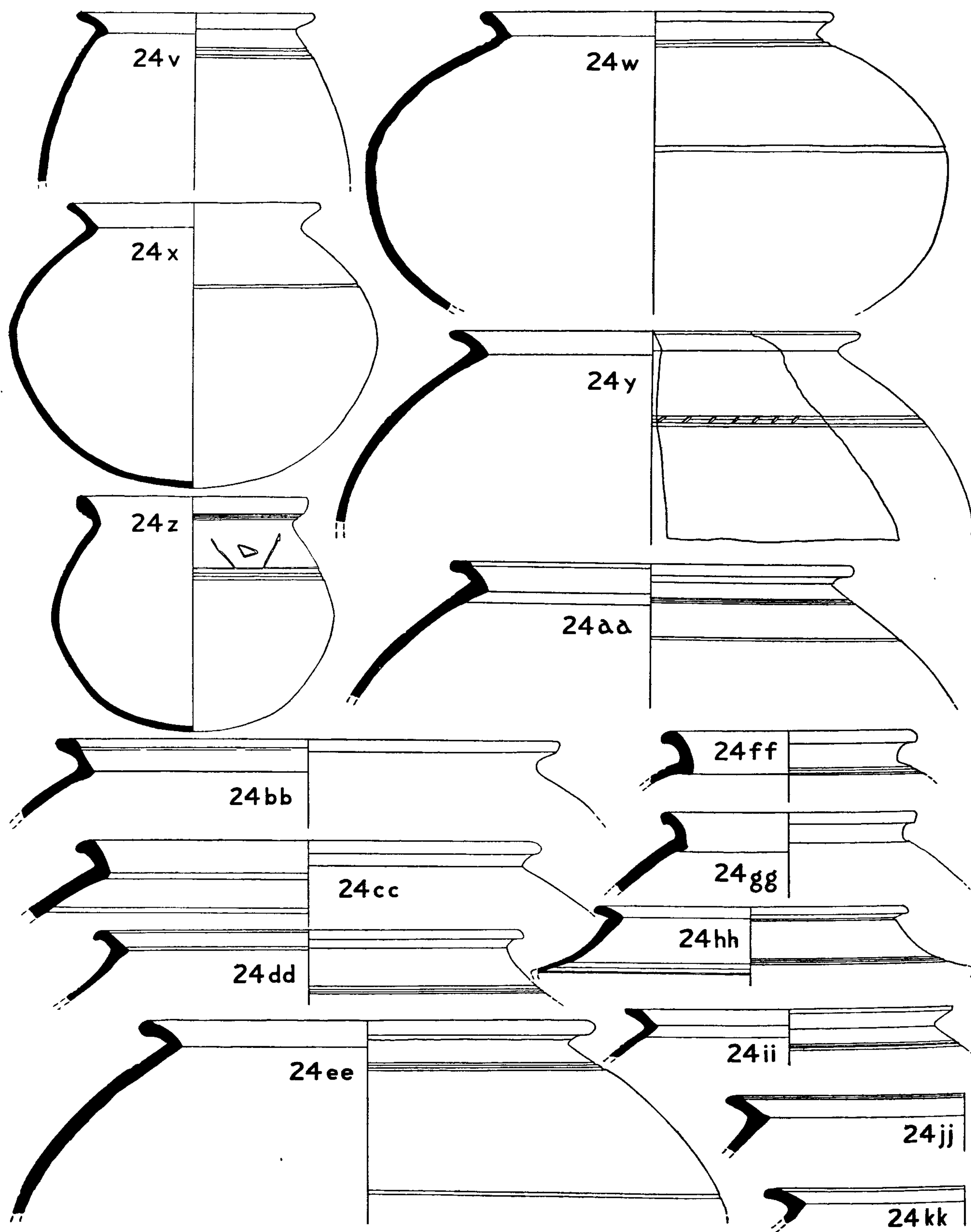


FIG. 20. *Type 24 (continued).* ¼

Arretine bowl stamped CAMVR. It is not sufficiently well preserved to indicate the presence or absence of a pinched lip for holding the wick.

Type 24, which is the most popular type of Arikamedu, served as a cooking vessel, as is evident from its usually soot-stained exterior. It has a convenient carinated shape and a prominent flanged rim which afforded an easy grip. Like the majority of the local types this is of a coarse fabric and is generally grey (sometimes salt-glazed) in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern and in all periods of the Southern Sector. It is usually treated with slip on the exterior surface. The arch-type is the most abundant, though variants 24*a–l* and 24*u* are also found in fair profusion throughout the occupation of both Sectors. Of the numerous variants of the type, 24*a–u* are carinated and 24*v–z* are uncarinated, the remaining varieties being too fragmentary to show the presence or absence of carination.

Of the carinated varieties, 24*a–l* deviate slightly from the parent type in the form of the rim, while the remainder differ also in other details. Variants 24*m–p*, which are appreciably smaller vessels, are very rare. Thus, while 24*n-o* occur sporadically in the Arretine layers of the Northern Sector, 24*p* is a unique find from a pre-Arretine layer (AK V, 11*a*) and 24*m* (a diminutive of 24*i*) from the Late Phase of the Southern Sector. Variants 24*o–t*, distinguished by a series of ridges at the shoulder, just above the point of carination, form a sub-class by themselves. Of these 24*q* with a groove on the top of the rim occurs occasionally in all phases of the Southern Sector, while 24*r–t* are unique examples respectively from a post-Arretine layer of the Northern Sector, Pottery Group A (Early Phase) of the Southern and from an Arretine layer (AK V, 8N). Variant 24*u*, with a thick wall and a groove on the top of the rim, occurs frequently in all periods of both Sectors.

Of the uncarinated varieties, viz. 24*v–z*, the first and the last represent unique specimens with an elliptical body and distinctive rim-forms; derived from pre-Arretine layers (AK V, 10N and AK II, 14). Variant 24*w* is a large vessel with a pronouncedly bulging profile, also from the pre-Arretine level (AK II, 14), while varieties 24*aa* (from the same layer), 24*y* (ornamented with a row of slanting incised strokes on the shoulder, from the Main Drain Phase of the Southern Sector) and 24*ee* (from the Arretine layer, AK II, 8A) exhibit a profile analogous with 24*w*, though they are fragmentary and have different rim-forms. Variant 24*x*, which is peculiar to the earliest layer of the Pre-structural Phase of the Southern Sector, is a red-ware vessel with a globular body, originally covered with a lid, Type 28*i*. Variant 24*bb* is a red-ware pot peculiar to Pottery Group A (Early Phase) of the Southern Sector, but deviates very slightly from 24*aa* which is of a coarse grey fabric, from a pre-Arretine layer. Variant 24*cc* is a thicker derivative of the same in coarse red ware and is a solitary specimen from a mixed group (AK V, pit 1). 24*dd* and 24*hh* are two other unique red-ware variants, peculiar to Pottery Group A (Early Phase) of the Southern Sector. Variants 24*ff-gg* on the other hand, are fairly common shapes and occur throughout the occupation of both Sectors. Variant 24*ii*, however, is a unique red-ware vessel from the Early Phase of the Southern Sector, while 24*jj* in red ware and 24*kk* in grey ware are confined respectively to the Late Phase of the Southern Sector and the lowest Arretine layer (AK II, 8 green) of the Northern.

Type 25 is a shallow carinated frying pan, its function usually being indicated by a charred exterior. Like the cooking vessel (Type 24), this has a prominent flanged rim to afford an easy grip. It is of a coarse fabric and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all periods of the Southern. Variants 25*a–f*, slightly deviating from the arch-type, are occasionally found throughout the occupation of both Sectors. Variants 25*g* and 25*k-l*, distinguished by thick bodies with short rims, are peculiar to the pre-Arretine layers, while 25*h* is confined to the Arretine and post-Arretine periods of the Northern Sector. Variant 25*i* is a solitary red-ware pan of thick gritty fabric from Pottery Group A (Early Phase) of the Southern Sector, while 25*j* with a double carination is a unique specimen from the post-Arretine period of the Northern Sector. Similarly 25*m* is a solitary variant from the Main Drain Phase of the Southern Sector, and 25*n* from a pre-Arretine layer (AK V, 10N) of the Northern. Handled frying pans are extremely rare, with only four fragmentary examples, 25*o–r*, which differ from each other in shape and fabric. Variant 25*o*, of a coarse greyish red fabric from the Late Phase of the Southern Sector, has a horizontal loop-handle, while the remaining variants have vertical handles of similar shape. Variant 25*p* of greyish red ware is from a mixed group (AK VIII, pit 1), while 25*q-r* are of coarse grey ware, the former with greyish pink slip and the latter with chalky slip, respectively from the Arretine horizon (AK III, layer 6) and from near the surface of the Northern Sector. It is noteworthy that 25*p* and 25*r* have on either flank of the handle a nail-like projection, presumably a copy of a metal prototype.

Type 26 is a pan distinguished by a beaded rim. This is a rare type and invariably occurs in grey ware of fine fabric. It comes from the post-Arretine period of the Northern Sector. It has two variants, 26*a* and 26*b*, both from a mixed deposit.

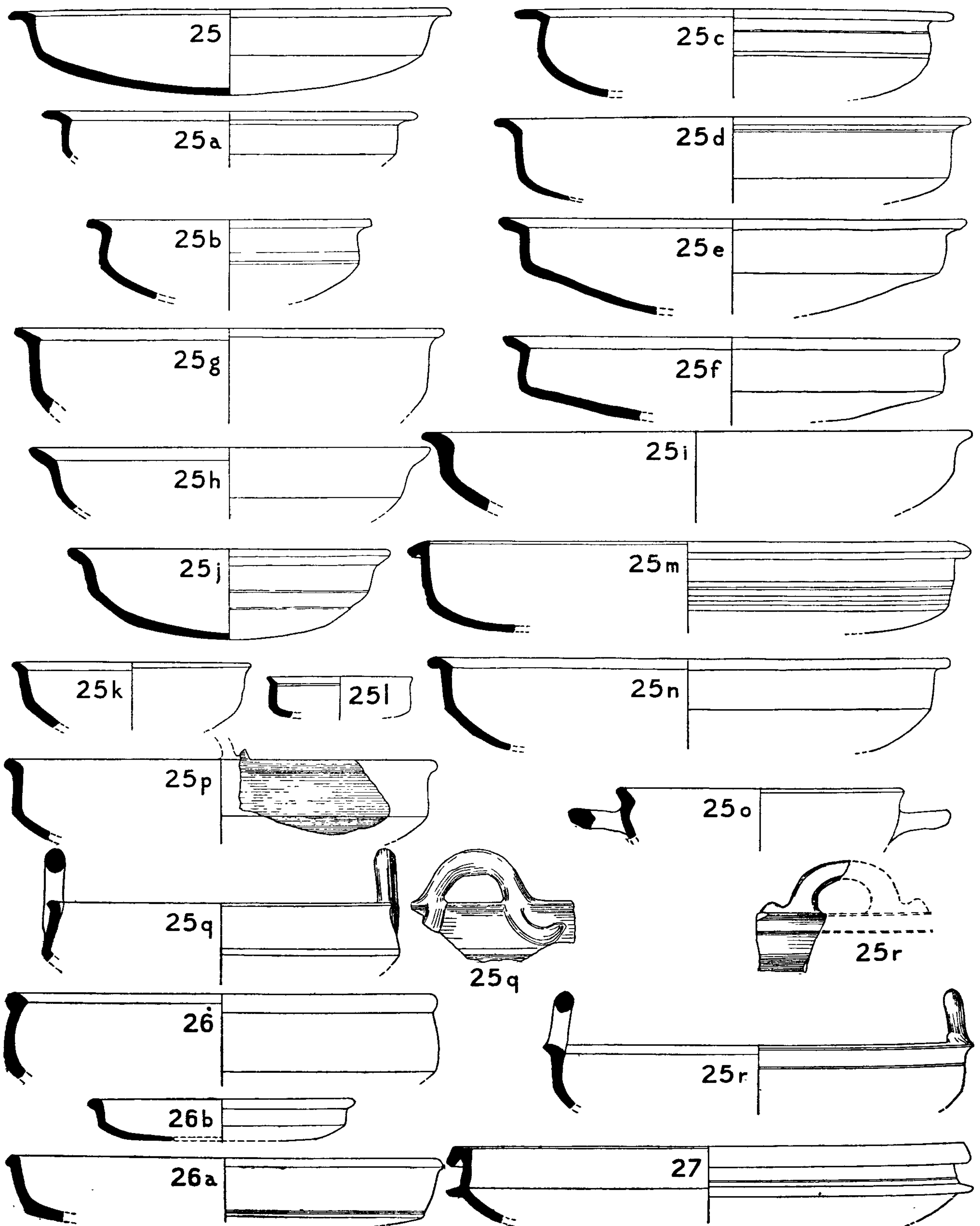


FIG. 21. *Types 25–27.* ¼

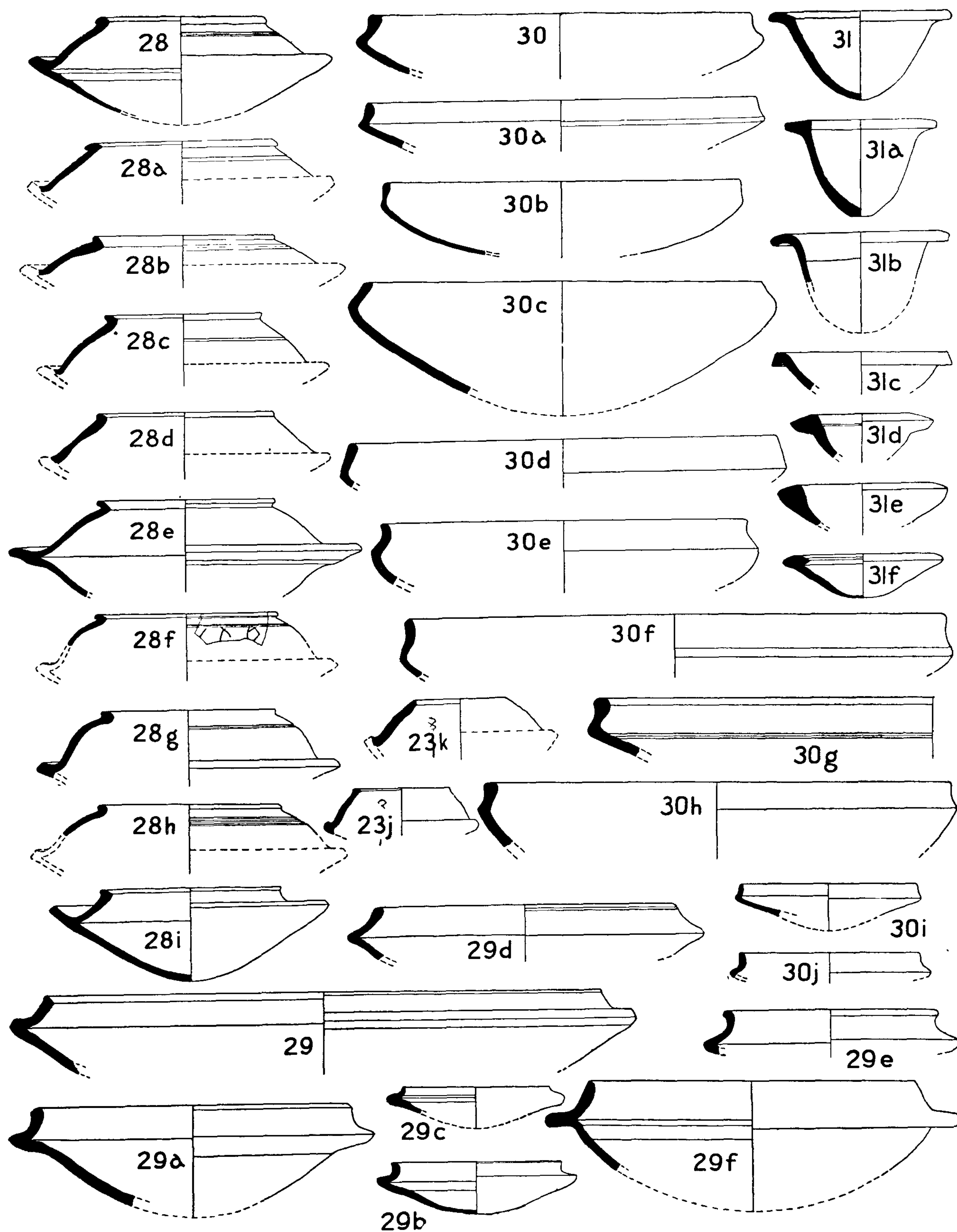


FIG. 22. *Types 28–31.* ¼

Type 27 is a unique pan with two flanges in coarse grey ware, from a pre-Arretine layer (AK V, 9N).

Type 28, with a pronounced flange at the waist and a sagger base, functioned as a lid for the cooking vessel Type 21, a variety of which, actually covered with a lid of this type (28*i*), was found in one of the earliest pre-structural layers of AK IV. This is one of the principal types of the site and is present in fair quantity throughout the occupation of both Sectors. The type is of a coarse fabric and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all periods of the Southern. The slip on this type is normally applied on the portion above the flange, the lower portion being left plain. The arch-type is the most popular, though variants 28*a–d* occasionally occur throughout the occupation of both Sectors. The arch-type deviates but slightly from the variants, among which 28*e-f* and 28*g-h* form analogous pairs. Variants 28*e*, 28*h* and 28*f* are peculiar respectively to the pre-Arretine, Arretine and post-Arretine periods of the Northern Sector, while 29*g* is a unique specimen from the Late Phase of the Southern Sector and 28*i* from one of the earliest pre-structural layers of the same Sector. Variants 28*j-k*, the former from the post-Arretine period of the Northern and the latter from the Late Drain Phase of the Southern Sector, are rare varieties of this type.

Type 29 is another lid-type which shares the fabric and sagger base of Type 23 but differs from it in being rimless and in having a less prominent flange. Its arch-type partially resembles Type 28*i*, though it is much larger in size and has a different form of flange. This type is absent from the pre-Arretine and Arretine phases of the Northern Sector; it occasionally occurs in the post-Arretine period of the Northern Sector and at all periods of the Southern. This is also true of variants 29*a-b*. Variants 29*c-d* and 29*f* are peculiar to the post-Arretine period of the Northern Sector, while 29*e* is a unique specimen from the Early Phase of the Southern.

Type 30 is a carinated lid-type, sometimes with a thickened rim. It is of a fabric identical with that of Types 28 and 29 and has an analogous base form. It is fairly popular and, together with variants 30*a-b* and 30*g*, occurs in all periods of both Sectors. Variant 30*b*, also with a thickened rim but with a wider angle of carination, is a unique variant from Pottery Group A (Early Phase) of the Southern Sector. The thickened rim is absent from the remaining varieties, of which 30*j*, representing a small lid, is occasionally found throughout the occupation of both Sectors, while 30*i*, which is even smaller than 30*j*, is peculiar to the post-Arretine period of the Northern Sector. Variants 30*c-d* and 30*e-f* form analogous pairs, the former having an unusually pronounced sagger base and the latter a prominently concave profile above the carination. Of these, variants 30*d* and 30*f* are peculiar to Pottery Group A (Early Phase) of the Southern Sector, while 30*c* and 30*e*, the former of a coarse red fabric and the latter of coarse grey ware with chalky slip, are unique examples respectively from a post-Arretine layer and a mixed group (AK VIII, pit 1) of the Northern Sector.

Type 31 is a lid in the form of a deep cup with a rounded base and flanged rim. Like lid-types 28–30, it is of a coarse fabric and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all phases of the Southern. The arch-type and variant 31*a*, which is closest to it, occur in fair quantity throughout the occupation of both Sectors. Variant 31*b*, also with a prominent flanged rim, is peculiar to the Late Drain Phase of the Southern Sector. The remaining variants are all shallow with different rim-forms and are extremely rare. Variant 31*c* with a short heavy flange is confined to the Pre-structural Phase, while 31*d* with a heavier flange is a unique example from the Late Drain Phase of the Southern Sector. Variants 31*e-f*, the former distinguished by a thick clubbed rim and the latter by a rim showing both inward and outward projection, are solitary specimens belonging to the post-Arretine period of the Northern Sector.

Type 32 is a lid in the form of a shallow dish with a rounded base and internally beaded rim. It is usually of a fine grey fabric, though two specimens are known also in coarse greyish red ware from the Southern Sector. It is a rare type but appears sporadically in the post-Arretine period of the Northern Sector and all phases of the Southern. This is also true of variants 32*a-b*, while 32*c*, representing a small lid, is a unique example from a mixed group (AK III, pit 2).

Type 33 is a very rare type of lid with base similar to Type 32 and a thick rim showing an inward projection. It is of a coarse greyish red fabric, though a solitary example of it is known also in fine grey ware from the Late Phase of the Southern Sector. The main type and variant 33*a* occur sporadically in the post-Arretine period of the Northern Sector and all phases of the Southern, while 33*b* is a unique variety of larger size from Pottery Group A (Early Phase) of the Southern Sector.

Type 34 is another lid-type in the form of a dish, distinguished by a sagger base and inverted rim. It occurs occasionally throughout the occupation of both Sectors. It is of a coarse fabric and is generally grey in the pre-Arretine and Arretine and red in the post-Arretine period of the Northern Sector and all periods of the Southern.

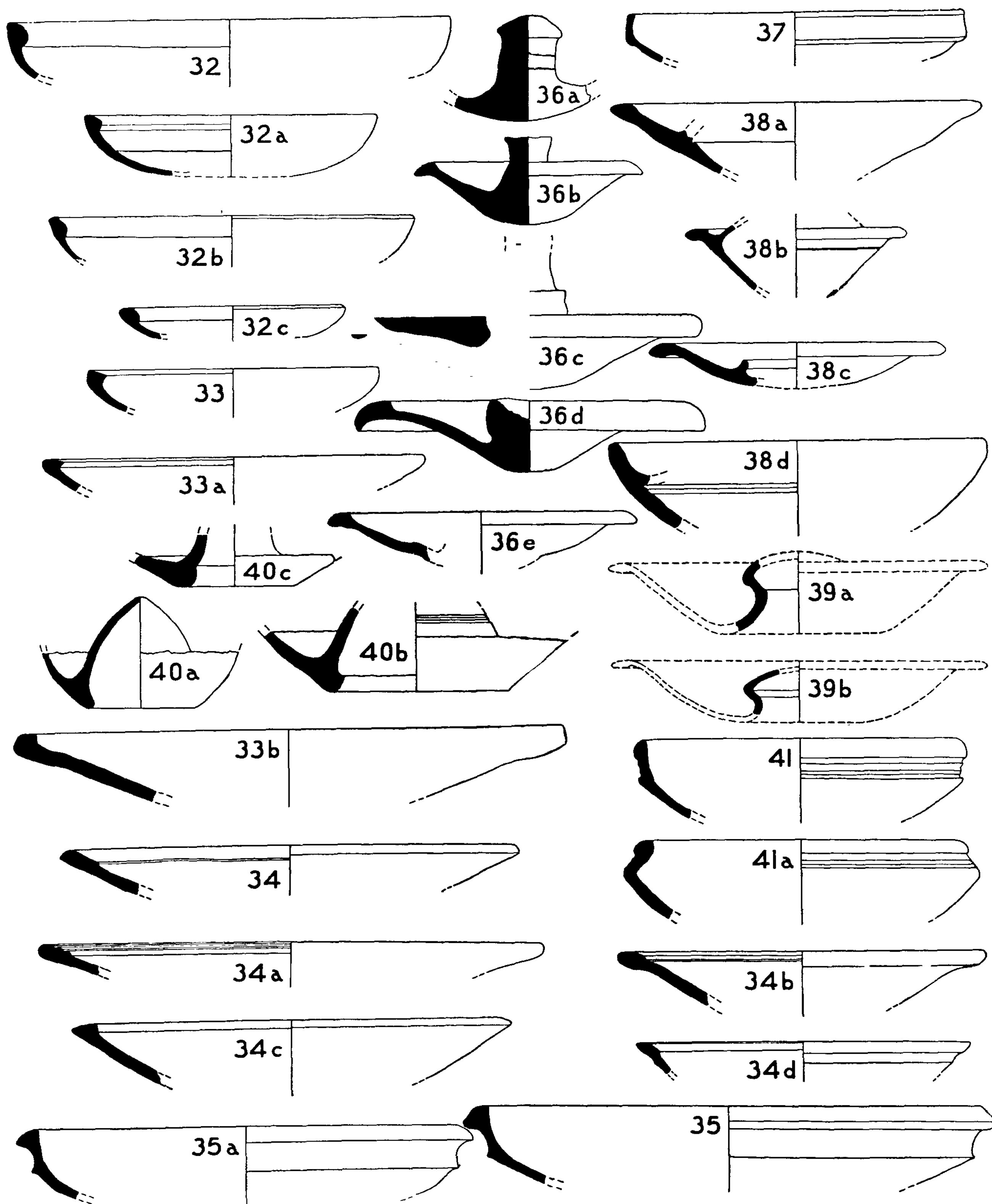


FIG. 23. *Type 32–41.* ¼

Usually it is treated with a slip on the interior face but never on the exterior. Variants 34*a–c*, the first two showing slight deviation from the arch-type and the last having a clubbed rim, are peculiar to the Arretine layers of the Northern Sector, while 34*d* is a unique specimen from a pre-Arretine stratum (AK II, 14).

Type 35 is a lid distinguished by flanges at the rim and the waist and represented by only two specimens, which are illustrated (Types 35 and 35*a*). Both are of a gritty micaceous buff fabric, the former coming from Pottery Group A (Early Phase) and the latter from the Late Phase of the Southern Sector.

Type 36 is a saucer-shaped lid with a sagger base and thick solid knob-handle in the middle. This type is very rare and the few examples of it vary in regard to the shape of the knob and rim and are consequently all illustrated. Variant 36*a* is a fragmentary coarse grey-ware lid from a pre-Arretine layer (AK V, 10N), while 36*b*, representing the only complete piece, is of a cruder grey fabric from the Arretine horizon (AK VIII, layer 5). Variant 36*c*, from a mixed deposit (AK VIII, spoil trench 3), is a thick grey-ware lid with smooth chalky slip on both faces and has a long fragmentary knob, while 36*d* is of a coarse greyish red fabric with haematite slip on both faces from Pottery Group A (Early Phase) of the Southern Sector. Variant 36*e* is of greyish buff ware, knob missing, from an Arretine layer (AK II, 10A).

Type 37 is another dish-shaped lid, characterized by a groove below the point of carination. It is of a fine grey fabric, and is represented by only two specimens, one from Pottery Group A (Early Phase) of the Southern Sector and the other from a mixed group (AK VIII, pit 3).

Type 38 is a combined cup-and-saucer shaped lid with a rounded or sagger base, and is represented by four fragmentary examples all of which have unique features and are illustrated as variants. They are of coarse greyish red ware with red slip inside and, except 38*e*, come from the post-Arretine period of the Northern Sector. Variant 38*a* is in the form of a thick large saucer with the central cup broken off, while 38*b* is a smaller lid with a rounded base and preserves only the lower portion of the cup. Variant 38*c* from an unstratified deposit (AK I) of the Southern Sector shows a wide flaring rim and well-preserved shallow cup, while 38*d* is a thick deep rimless saucer with only the stump of the cup remaining.

Type 39 is a lid characterized by a hollow knob with a neck. Like Type 38, it probably had a saucer-shaped body which is missing. Only two fragmentary examples of it have survived. Variant 39*a* is of a coarse greyish red fabric with red slip on the upper face and comes from the post-Arretine phase of the Northern Sector, while variant 39*b*, from a mixed deposit (AK VIII, pit 1), is squatter in shape and of coarse grey ware with a chalky slip on the upper face.

Type 40 is another lid-type with a hollow knob-handle, which, unlike Type 39, is conical in shape. This occurs exclusively in the post-Arretine layers of the Northern Sector and is represented by three fragments of varying shapes which are all illustrated. Variant 40*a*, the best-preserved, shows a complete knob and is of greyish buff fabric with chalky slip, while 40*b*, of which only the lower half of the knob remains, is of coarse greyish red ware with red slip. Variant 40*c* is a fragment of a coarse grey fabric with chalky slip.

Type 41 is a carinated lid or dish with a sagger base and is distinguished by a thick body, beaded rim and externally grooved neck. It is of a coarse greyish red fabric, sometimes with a red slip on the outer face, and occasionally occurs in the post-Arretine period of the Northern Sector and all phases of the Southern. Variant 41*a* resembles the main type in all respects save that the angle of the rim is oblique. This variant is peculiar to the Southern Sector but occurs throughout the occupation of that Sector.

Type 42 is a small pot with a flaring rim, narrow neck and globular body. It probably functioned as a water-vessel, a similar shape both in pottery and metal being still used in many parts of India for this purpose. This type is of a coarse fabric and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and at all periods of the Southern. The main type and variants 42*b-c* occur occasionally throughout the occupation of both Sectors. Variant 42*a*, a solitary tiny model of the arch-type, is of red-slipped coarse red ware and comes from Pottery Group A (Early Phase) of the Southern Sector. Variants 42*b–d* deviate from the arch-type in exhibiting a progressively increasing bulge at the belly. Variants 42*d-e* are peculiar to the post-Arretine period of the Northern Sector, the former being of a coarse grey fabric with polished chalky slip and the latter of coarse greyish red ware with a slight rib at the shoulder and above the neck. Variant 42*f* represents a diminutive vase, of a shape approaching 42*e*, of chalky slipped thin coarse grey ware, from a mixed deposit (AK VIII, pit 3). Though fragmentary, variant 42*g* appears to have a pear-shaped body with an unusually long neck, while 42*h* shows a still longer neck. Variant 42*g* is of a coarse greyish red fabric with red slip and is a solitary example from Pottery Group A (Early Phase) of the Southern Sector. Variant 42*h* occasionally occurs throughout the occupation of the Northern Sector and is grey in the pre-Arretine and Arretine layers and red in the post-Arretine. Variants 42*i-j* are rare; they are of a red-slipped

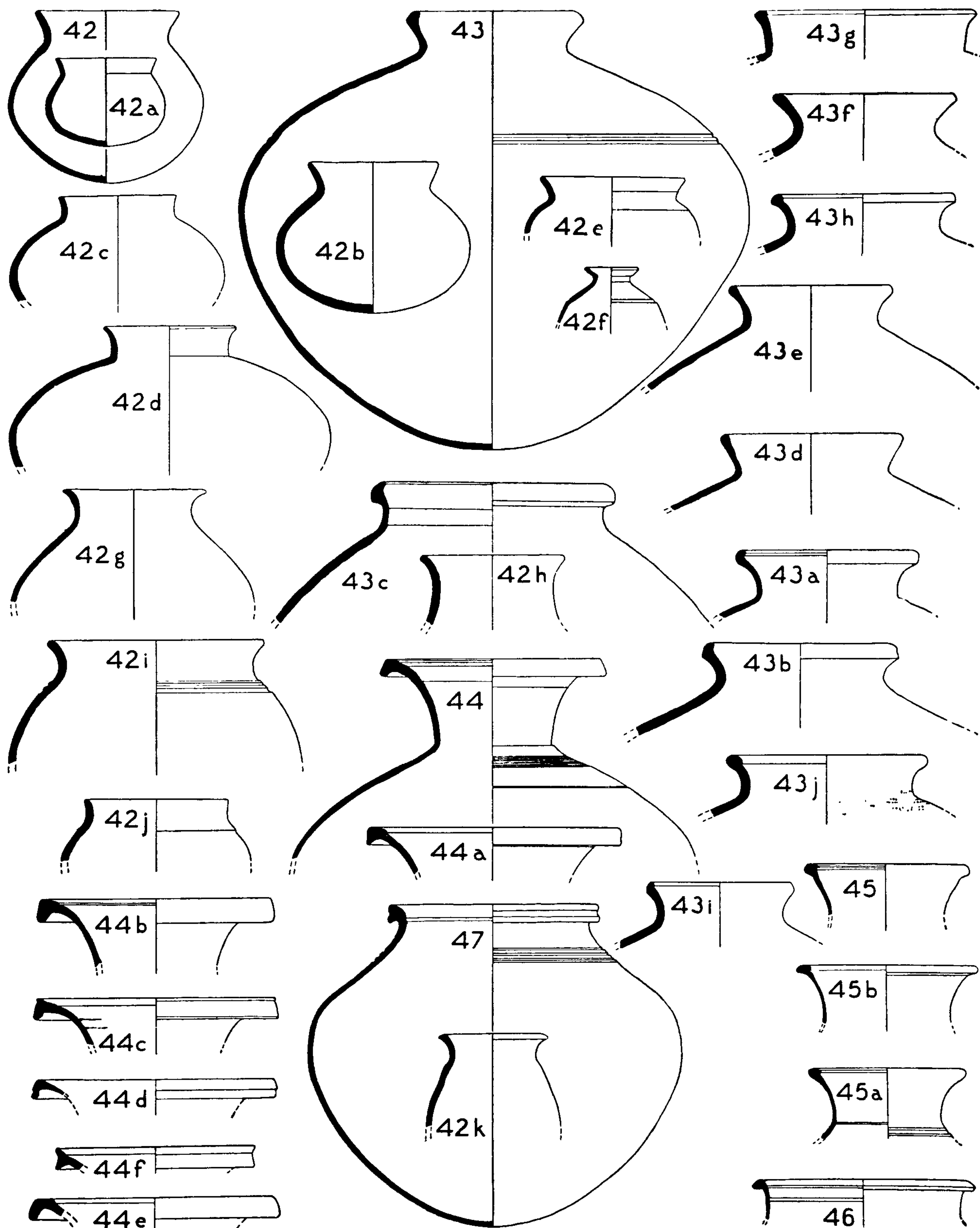


FIG. 24. *Types 42–47.* ¼

coarse greyish red fabric from the post-Arretine phase of the Northern Sector, the former being distinguished by a grooved shoulder and the latter by a short rim and a rib at the shoulder. Variant 42*k* is a unique little pot of buff ware, from an Arretine layer (AK II, 8A).

Type 43 is a larger water-vessel than Type 42, usually with a recurved or thickened rim, short neck and globular body, and is doubtless a *ghaṭa* (i.e. vessel for fetching and keeping water) as used down to modern times in many parts of India. This is one of the principal types of the site, occurring throughout the occupation of both Sectors. It is of a coarse fabric and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all periods of the Southern. Variants 43*a*, 43*d–f*, 43*h-i* and 43*k* occasionally occur through all periods of both Sectors. Variants 43*b-c* have an exceptionally recurved or hooked rim, the former being of coarse grey ware from a pre-Arretine layer (AK V, 11A) and the latter of coarse red ware from the Pre-structural Phase of the Southern Sector. Variants 43*g–k* are distinguished by an internally beaded rim. Of these, 43*g* in coarse grey ware is peculiar to a pre-Arretine layer (AK II, 14), while 43*j* is a unique piece in black-slipped coarse grey ware, decorated on the neck with irregular rows of pin-prick ornament, from an Arretine layer (AK V, 8N).

Type 44 is of black-slipped grey ware of fine fabric, and has a distinctive flaring high neck and everted rim. The rarity of the type combined with its careful potting shows that it belonged to a superior class of vessel. The arch-type, which is figured from the best preserved specimen, has a series of fine grooves on the shoulder. The body of this type is either round or elliptical, probably the latter, but the shape of its base is not known. Its variants, which are very fragmentary, deviate from the arch-type in the form of the rim. While variants 44*a–c* occur sporadically throughout the occupation of both Sectors, variants 44*d-e* are peculiar respectively to the pre-Arretine and post-Arretine period of the Northern Sector, and 44*f* to Pottery Group A (Early Phase) of the Southern Sector.

Type 45 is a fragmentary vessel of a ware identical with that of Type 44. It has a neck similar to that of Type 44 but with a distinctive knobbed rim. This type is extremely rare, and together with variants 45*a-b* occurs sporadically throughout the occupation of both Sectors.

Type 46 is a neck-fragment of a jar with an everted rim. It is of a thin greyish red fabric with red slip, and comes from the Pre-structural Phase of the Southern Sector.

Type 47 is represented by a solitary complete specimen from the French excavations (Northern Sector, approximately mean sea-level, equivalent to our Arretine levels) and is roughly assignable to the earlier half of the first century A.D. It is a coarse greyish red-ware pot of an ovoid shape, but smaller in size than Types 43-44, and has a distinctive grooved rim.

Type 48 represents a large storage jar with a wide mouth and flaring rim, but otherwise of an unknown shape. This is one of the characteristic types of the site and occurs occasionally throughout the occupation of both Sectors. It is of a coarse fabric and is usually grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all periods of the Southern. It has invariably a slip on the outer face. Its variants (48*a–e*) have the same fabric and distribution.

Type 49 is a rare jar-type with a wide neck and short flaring rim, akin to Type 48, which it also resembles in fabric. It occurs sporadically in the Arretine and post-Arretine layers of the Northern Sector and through all phases of the Southern. It invariably shows a slip on the outer face, and is generally grey in the Arretine layers and red elsewhere.

Type 50 is a very rare type of jar with a flaring and thickened rim. Its size is smaller and neck relatively narrower than that of Types 48-49. This type invariably occurs in coarse greyish red ware with a red slip outside, and is confined to the pre-Arretine layers of the Northern Sector.

Type 51 is another rare type of jar distinguished by thin walls, a small rim and hardly any neck. The complete shape of the type may be visualized from its two diminutive variants, 51*e-f*, both of coarse grey ware with chalky slip from the Arretine layers (AK II, 7 Ar. and 8A) of the Northern Sector. The main type with a rolled rim occurs exclusively in the Pre-structural Phase of the Southern Sector and is of a red-slipped coarse greyish red fabric; while variant 51*a*, with a sharp externally beaked rim, shares the fabric with the main type and is a unique piece from the Late Drain Phase of the same Sector. Variants 51*b–d*, like 51*e-f*, are chalky-slipped coarse grey wares, occurring exclusively in the Arretine layers of the Northern Sector.

Type 52 is a large jar with a wide flaring neck and externally clubbed rim. The type is rare but occurs sporadically throughout the occupation of the Northern Sector. It is of a coarse fabric treated with slip outside, and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine, though exceptional red examples occur in the pre-Arretine and grey in the post-Arretine period. Of the variants, 52*a* is

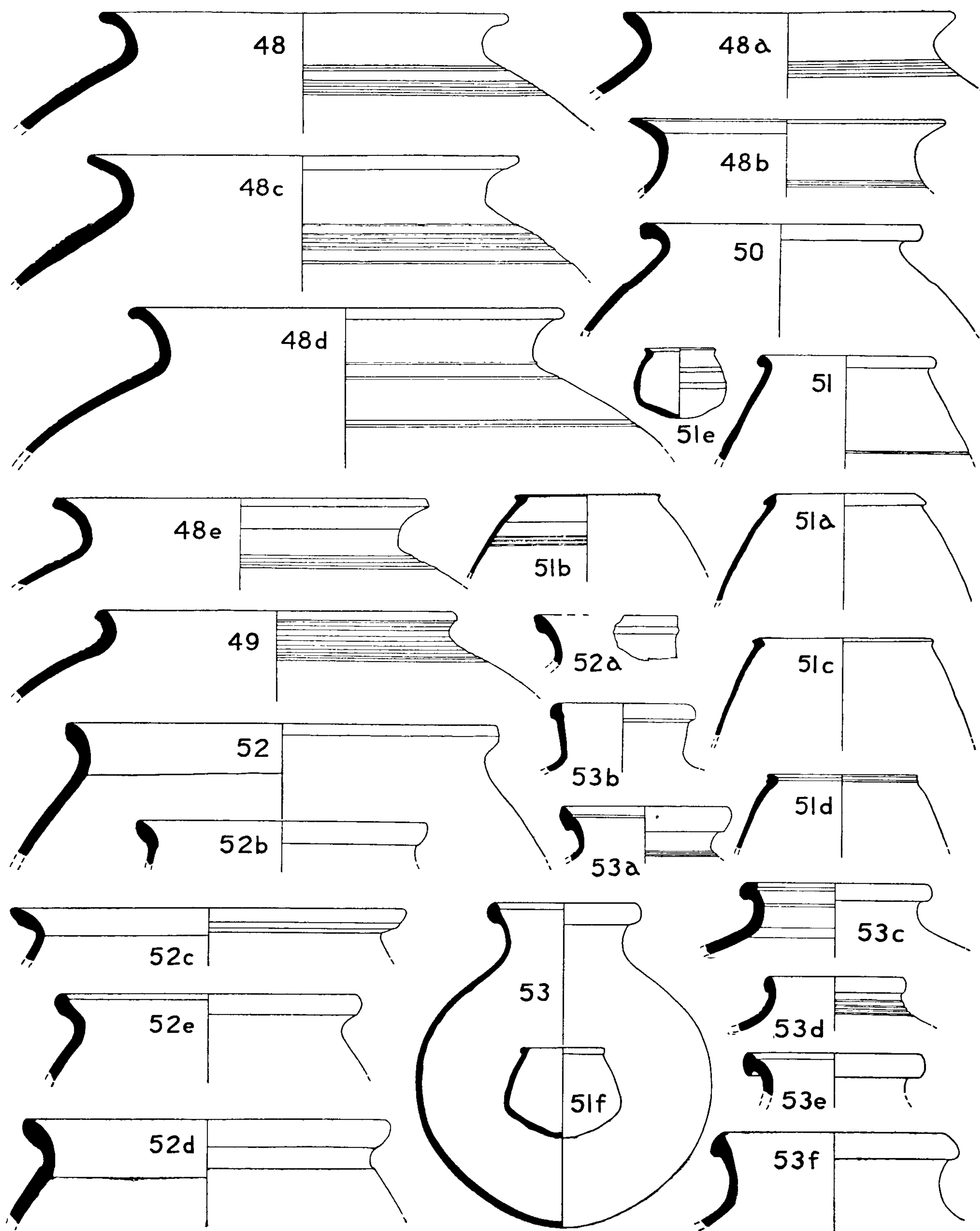


FIG. 25. *Types 48–53.* ¼

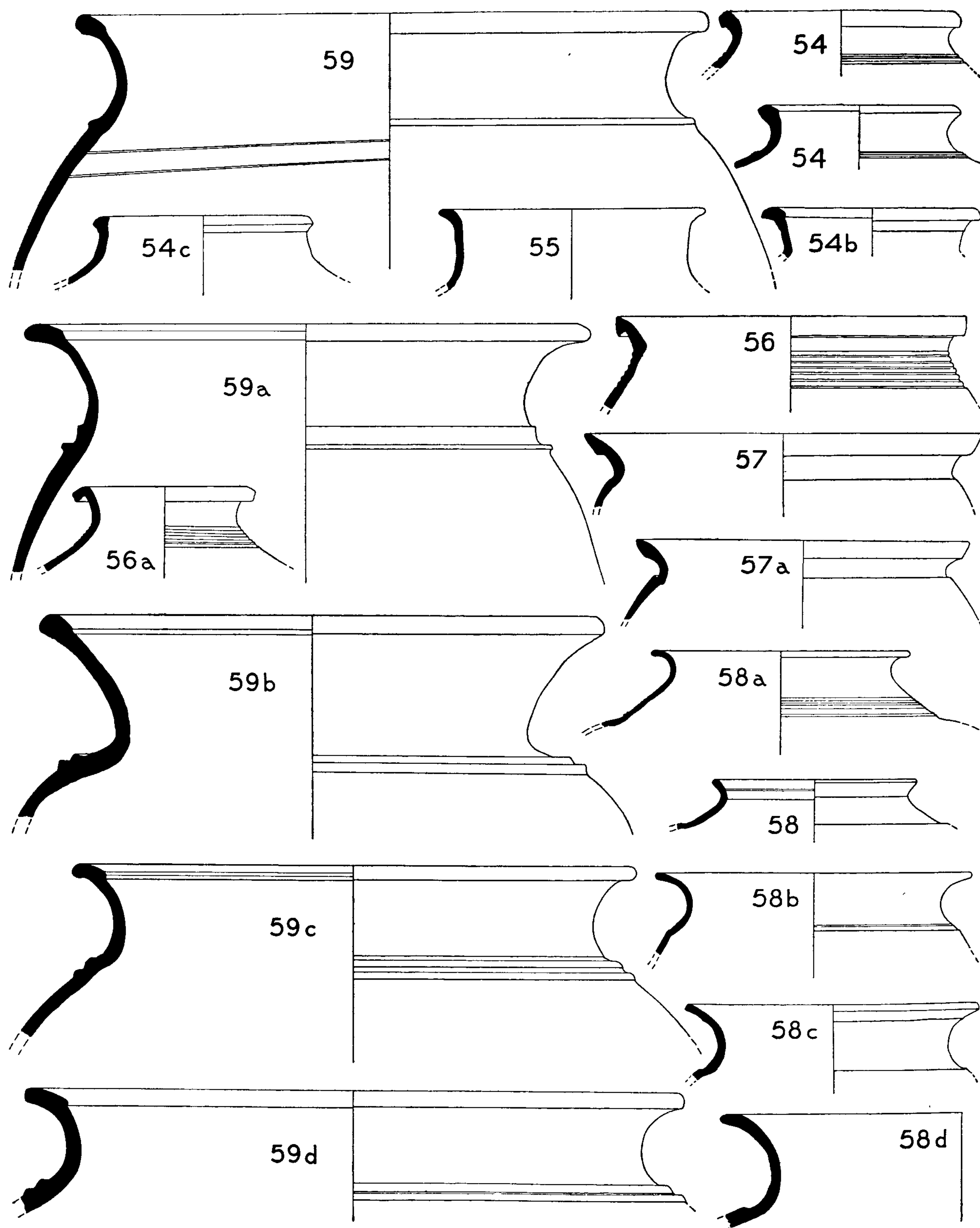


FIG. 26. *Types 54–59.* ¼

characteristic of the Arretine layers with an occasional overlap into the post-Arretine phase, while 52*b*–*e*, the last showing a slightly recurved rim, are peculiar to the post-Arretine phase. A solitary specimen of variant 52*c* is of coarse greyish black ware with black slip.

Type 53 represents a small water-vessel, characterized by a spherical body, narrow neck and pronounced rim with an internal groove. It is a rare type but occurs sporadically in the post-Arretine period of the Northern Sector and all phases of the Southern. The type is of a coarse greyish red fabric, usually treated with red and sometimes with haematite slip. A freak variant of this type, 53*e*, is of a coarse greyish black ware with black slip from the lowest Arretine layer of the Northern Sector (AK II, 8 green). Variant 53*a*, which is closest to the main type, is peculiar to the post-Arretine period of the Northern Sector, while 53*b* and 53*d* are confined respectively to the Pre-structural and Early Phase of the Southern Sector. Variants 53*c* and 53*f* are neck-fragments of larger jars, the former coming from a mixed group (AK VIII, pit 1) and the latter from the Late Phase of the Southern Sector.

Type 54 is a medium-sized jar with a narrow neck and thick out-turned rim. The shape of its lower part is not known. This type is occasionally present throughout the occupation of both Sectors. It is of a coarse fabric, usually treated with slip outside, and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine layers of the Northern Sector and all periods of the Southern, though red examples occur exceptionally in the pre-Arretine layers and grey in the post-Arretine. Variants of this type are rare. Variant 54*a*, of a chalky-slipped coarse grey fabric, is peculiar to the post-Arretine phase of the Northern Sector, while 54*b*, of red-slipped coarse greyish red ware, is a unique piece from a pre-Arretine layer (AK II, 14). Variant 54*c* is of red-slipped coarse red ware and comes from the Pre-structural Phase of the Southern Sector.

Type 55 is a rare jar with a high neck and flaring rim, occurring sporadically throughout the occupation of both Sectors. It is of a coarse fabric treated with slip outside, and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all phases of the Southern. The shape of this type below the shoulder is unknown.

Type 56 is the upper part of a fairly large jar distinguished by an undercut rim and a series of grooves on the shoulder. It is a type confined to the post-Arretine phase of the Northern Sector and is invariably of a coarse greyish red fabric with polished red slip (often of haematite). Variant 56*a*, of coarse greyish buff fabric with pale red slip, is derived from an Arretine layer (AK II, 7 Ar.).

Type 57 is the upper portion of a large jar with obliquely flanged rim, wide neck and ledged shoulder. This is a very rare type, represented by a few examples of light red or chalky-slipped coarse grey fabric, from the Arretine and post-Arretine phases of the Northern Sector. Variant 57*a*, represented by a solitary specimen from the Late Drain Phase of the Southern Sector, is of a red-slipped coarse greyish red fabric and shows a sharper nick at the shoulder than the main type.

Type 58 is a jar of thin ware, with a flaring rim and ledged shoulder. This is another rare type, occurring sporadically throughout the occupation of both Sectors. It is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all periods of the Southern. Variant 58*a*, of a thin micaceous buff fabric and with a more flaring rim than the arch-type, is peculiar to the Arretine layers of the Northern Sector, while variants 58*b*-*c*, with more splayed rims and sharper shoulder-ledges, are of a fine light red fabric and occur in the Early Phase of the Southern Sector, including Pottery Group A. Variant 58*d*, from the Late Phase of the same Sector, shares the shape of 58*b*-*c* but is of a thicker and coarser greyish red fabric with red slip.

Type 59 represents one of the largest and most characteristic storage-vessels of the site, with a wide flaring mouth, thickened rim and one or more ridges on the shoulder. It is present in fair quantity throughout the occupation of both Sectors. It is of a thick coarse fabric, treated with slip outside, and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all periods of the Southern. This is also true of variants 59*a* and 59*c*-*d*, which occur everywhere. Variant 59*b* with a thicker and blunter rim is of a red-slipped coarse greyish red fabric and is peculiar to Pottery Group A (Early Phase) of the Southern Sector. The shape of the base of this type is unknown.

Type 60 is a large storage-jar with wide mouth, sharply everted rim, short neck and multi-ridged shoulder. This is one of the characteristic types of the site and occurs in fair quantity throughout the occupation of both Sectors. It is of a thick coarse fabric, treated with slip outside, and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all phases of the Southern. Variants 60*a*-*b* share the range of fabric and distribution of the arch-type, while variant 60*c*, of a red-slipped coarse greyish red fabric, is peculiar to Pottery Group A (Early Phase) of the Southern Sector. The specimen

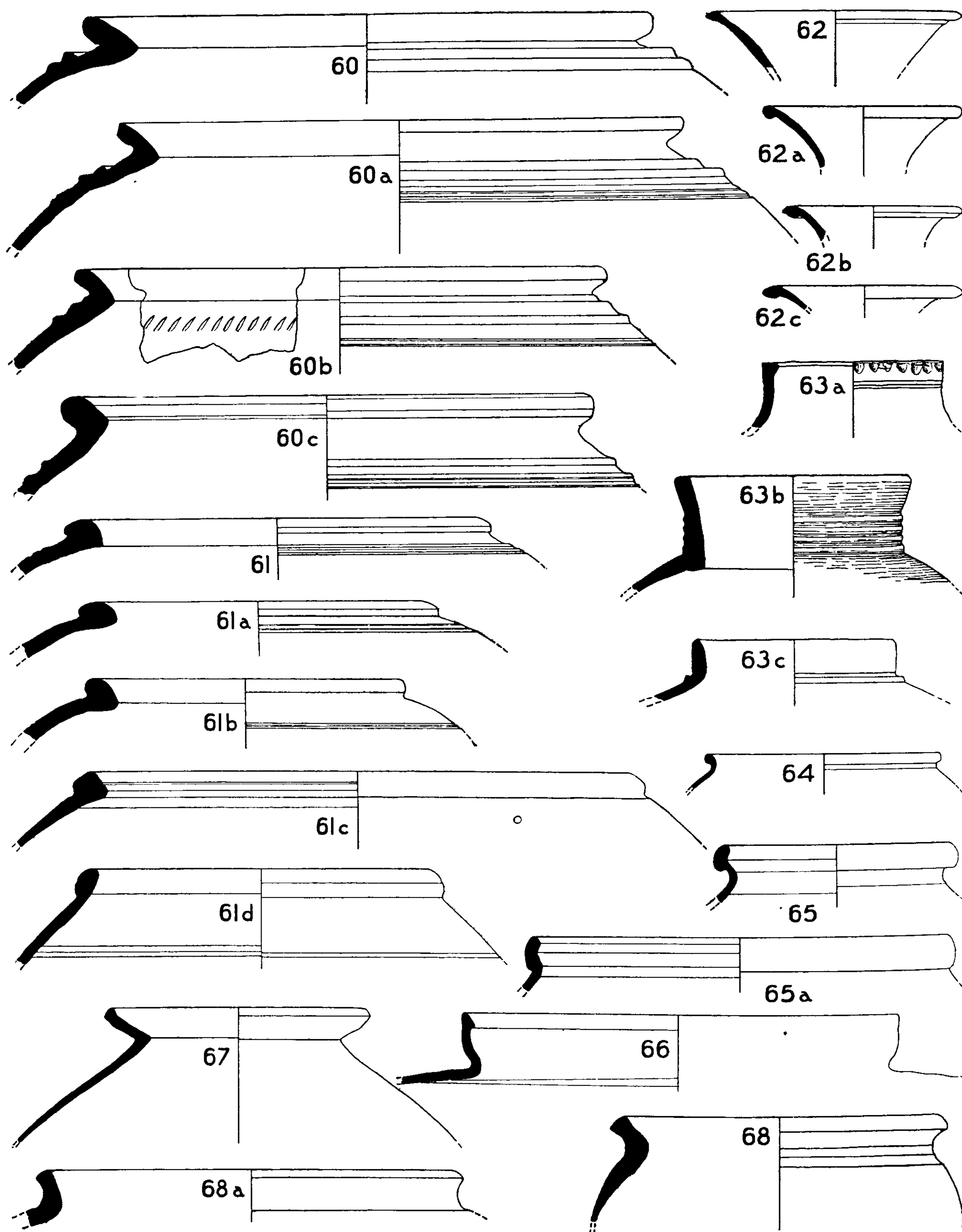


FIG. 27. *Types 60–68.* ¼

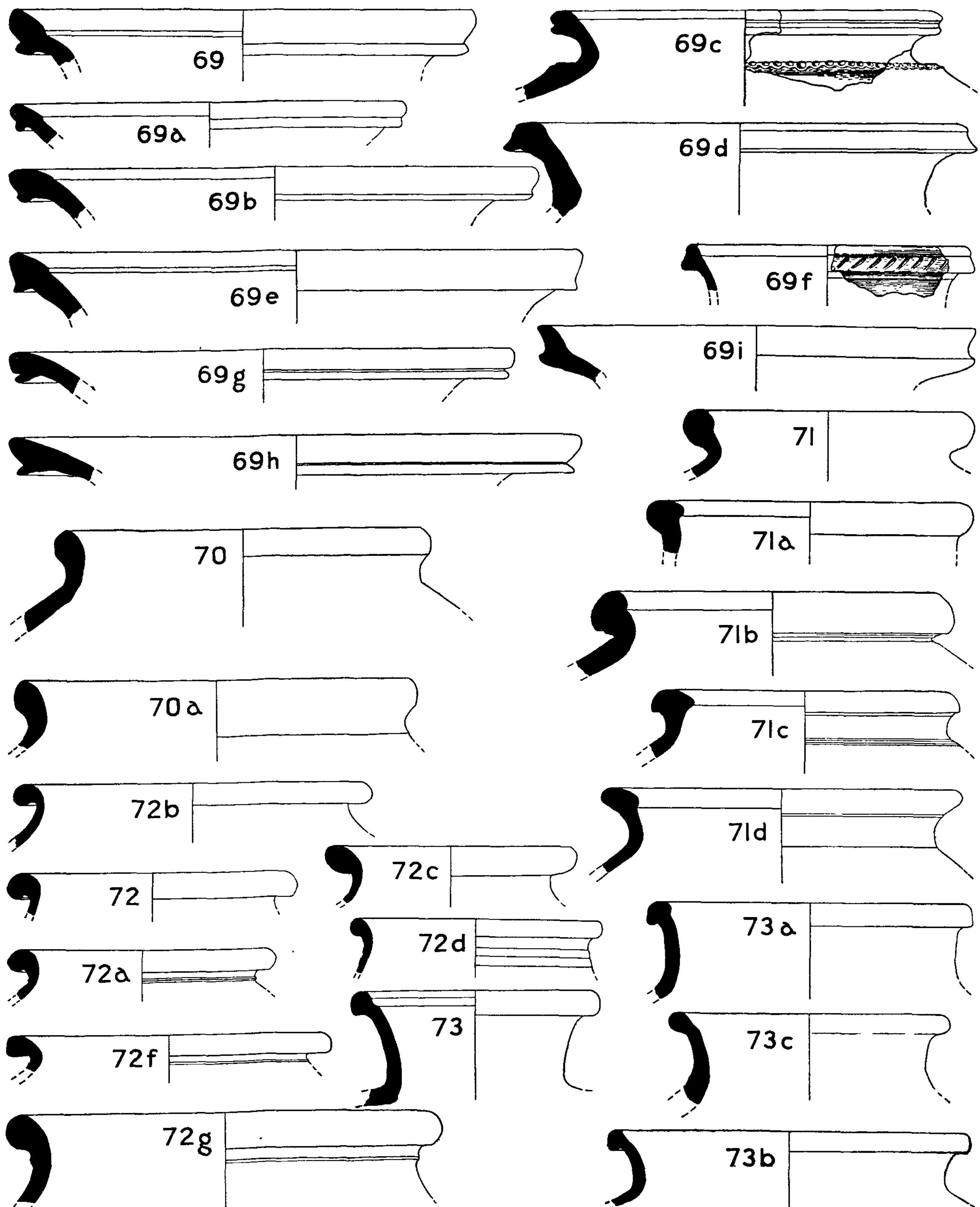


FIG. 28. *Types 69–73.* ¼

illustrating variant 60*b* has an individual feature in bearing a row of oblique slashes as decoration on the inside of the neck.

Type 61 is a jar of a size smaller than Type 60, with a wide mouth, clubbed rim and hardly any neck. This type occurs occasionally in the Arretine and post-Arretine phases of the Northern Sector and throughout the occupation of the Southern. It is of a thick coarse fabric, usually treated with slip outside, and is generally grey in the Arretine layers of the Northern Sector and red elsewhere. Variants 61*a-b* share the range of fabric and distribution of the main type, while variants 61*c-d* are of a coarse greyish red fabric. The former, with red slip outside and a secondary perforation on the shoulder, is a unique piece from the Late Phase of the Southern Sector, while the latter is a solitary variant from Pottery Group A (Early Phase) of the same Sector.

Type 62 is a fragmentary jar with a funnel-shaped neck. This is a type confined to the Southern Sector and occurs sporadically throughout its occupation. It is of a coarse greyish red fabric, treated with red slip. Variants 62*a–c* have the same fabric and distribution as the arch-type, from which they slightly deviate in the form of the rim.

Type 63 is a very rare jar-type with a fairly long straight neck and hardly any rim at all. This type, if such it can be called, is represented by only three examples of variant shapes which are all illustrated. Variant 63*a* is of chalky-slipped coarse grey ware with a row of roughly incised impressions on the exterior of the lip, from an Arretine layer of the Northern Sector (AK V, 8N). Variant 63*b* has ridges on the neck and is of coarse greyish red fabric with pink slip outside from a pre-Arretine layer (AK II, 13). Variant 63*c* is distinguished by a groove below the neck and a ridge on the shoulder, and is of gritty greyish red fabric, from the Main Drain Phase of the Southern Sector.

Type 64 is the neck-fragment of a small jar with a rolled rim. It is invariably of a fine grey fabric, usually treated with black slip and is confined to the Southern Sector, where it occurs through all phases except the latest.

Type 65 is a jar with an incurved rim. This type is peculiar to the Southern Sector and is occasionally present throughout its occupation. It is invariably of a coarse greyish red fabric treated with red or haematite slip. Variant 65*a*, which is larger in size but of similar ware and provenance, occurs less frequently.

Type 66 is the neck-fragment of a large vessel with an inward thickening of the rim. It is of a coarse greyish buff fabric, treated with red slip, and comes from Pottery Group A (Early Phase) of the Southern Sector.

Type 67 is the upper part of a jar with a sharply everted and slightly concave rim. It is of a coarse greyish buff fabric and is represented by only two examples, of which one is from Pottery Group A (Early Phase) of the Southern Sector and the other from the unstratified French excavations.

Type 68 is an extremely rare jar-type with a wide mouth and out-turned rim, occurring sporadically throughout the occupation of the Northern Sector. It is invariably of a thick coarse grey fabric treated with chalky slip outside. Variant 68*a* shares the ware and provenance of the arch-type, from which it deviates slightly in shape.

Type 69 is a fairly large jar distinguished by a grooved or flanged rim. It is one of the minor types, confined to the Arretine and post-Arretine phases of the Northern Sector. The type is of a thick coarse fabric and is generally grey in the Arretine and red in the post-Arretine phase. Its shape below the shoulder is unknown. Variant 69*a* has an analogous shape but is smaller in size; it is peculiar to the post-Arretine phase. Variant 69*b*, of a chalky-slipped coarse grey fabric, comes from an Arretine layer (AK II, 7 Ar.). All other variants are of red-slipped coarse greyish red fabric and, save for 69*d* (from the Early Phase of the Southern Sector), belong to the post-Arretine period. Unlike the type and other variants, 69*c* and 69*e* are ornamented, the former with a row of applied cable and the latter with incised slanting strokes.

Type 70 is a very rare jar with a wide neck and thickened rim. It is of a shape similar to type 52 but is thicker and larger in size. This type is of a coarse fabric, treated with slip outside, and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine phase of the Northern Sector and all periods of the Southern. The same is applicable to variant 70*a*.

Type 71 is again a rare jar characterized by a thick rolled rim. This type occasionally occurs in the Arretine and post-Arretine phases of the Northern Sector and throughout the occupation in the Southern. It is of a thick coarse fabric, usually treated with slip outside, and is generally grey in the Arretine layers of the Northern Sector and red elsewhere. Variant 71*a*, of a gritty grey fabric, is peculiar to the pre-Arretine horizon of the Northern Sector, while variants 71*b-c*, of a red-slipped coarse greyish red fabric, are confined to the post-Arretine and Arretine phase respectively of the same Sector. The last variant, 71*d*, is a derivative of the type in gritty greyish red ware and comes from Pottery Group A (Early Phase) of the Southern Sector.

Type 72 represents a jar distinguished by a thick voluted rim. It is one of the minor types, occurring occasionally throughout the occupation of both Sectors. It is of a coarse fabric, usually treated with slip outside, and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all phases of the Southern. Variants 72*a*, 72*c* and 72*f* share the ware and distribution of the main type, while 72*b* occurs in chalky-slipped coarse grey or greyish buff ware and is peculiar to the Arretine and post-Arretine periods of the Northern Sector. Of the remaining variants, 72*d* is of a coarse grey fabric from a pre-Arretine layer (AK V, 9N), while 72*f*, of a coarse greyish red ware, is confined to an Arretine layer (AK II, 8 green).

Type 73 is a jar with a narrow high neck and thickened rim, resembling Type 53*c*. It is a rare type but occurs sporadically in the Arretine and post-Arretine phases of the Northern Sector and throughout the occupation of the Southern. It is of a thick coarse fabric, treated with slip outside, and is generally grey in the Arretine layers of the Northern Sector and red elsewhere. Variants 73*a-b* have shorter and broader necks than the arch-type, the former being of a gritty micaceous greyish red fabric from the post-Arretine phase of the Northern Sector, and the latter of haematite-slipped coarse greyish red ware from a mixed deposit (AK VIII, pit 1). Variant 73*c* is represented by a solitary example of a coarse grey fabric with chalky slip from the lowest Arretine layer (AK II, 8 green). Like most of the jar-types, its shape below the shoulder is unknown.

Types 74-75, both fragmentary, appear to be the upper and lower part respectively of the same type, but, until this is proved by the recovery of a complete section, it is better to regard them as different types. Type 74 represents the head of a large vessel distinguished by a narrow aperture and thick lip with an inward slope. The largest fragment, which is 7¼ inches deep, shows a tendency to taper downwards. Type 75, on the other hand, is the lower part of a tall conical vessel tapering down to a point at the base which was obviously meant to be buried in the ground; indeed, many were found so buried (pl. XXXIIIA). The largest fragment of the latter is 29 inches from point to break.

Types 74 and 75 are both characteristic shapes of the site and occur in fair profusion throughout the occupation of both Sectors. They are identical in ware, being of a thick coarse fabric which is generally grey in the pre-Arretine layers of the Northern Sector and greyish red with grey core elsewhere. Type 75 has no slip at all, while Type 74 occasionally has a slip which is invariably confined to the portion above the shoulder. While Type 74 is completely wheel-turned, a remarkable feature of Type 75 is that it is hand-made up to a certain height from the base, above which it is wheel-turned. Put together, the two types would constitute a tall conical vessel, upwards of 35 inches high, which presumably functioned as a container of wine or oil like the imported amphorae, to which it bears a partial affinity. It may be noted that a group of eight jars of this type, some fitted into the broken remains of others, were found within an area of four square feet in a deep level of AK I of the Southern Sector.

Variants 74*a–d* are as common and widely distributed as the main type, from which they deviate very slightly in the form of the lip. Variant 74*e*, with an unusually pronounced beak, is confined to Pottery Group A (Early Phase) of the Southern Sector, while 74*f*, characterized by a multi-facetted lip, and 74*g-h* by drooping lips, are peculiar to the pre-Arretine layers of the Northern Sector. Variants 74*i–l* show relatively wider mouths, and all save the last are distinguished by thick clubbed lips. Of these, 74*i* is peculiar to the pre-Arretine and 74*j–l* to the post-Arretine phase of the Northern Sector. Variant 74*m* is a diminutive of this type and occurs fairly frequently throughout the occupation of both Sectors.

Variants of Type 75 may be distinguished by a slight diversity of base-forms. Variants 75*a-b*, distinguished by solid and more pointed base-forms, are peculiar to the Main Drain Phase of the Southern Sector, while 75*c* is a unique variant with a flat base from an unstratified deposit of the Southern Sector (AK I).

Type 76 is the largest storage-jar of Arikamedu, with a thick out-turned rim. It occasionally occurs throughout the occupation of both Sectors. Its fabric is thick and coarse, treated with slip outside, and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all phases of the Southern. Variant 76*a*, distinguished by ridges on the shoulder and a slightly different rim-form, shares the range of fabric and distribution of the arch-type.

Type 77 is a somewhat smaller jar than Type 76 and is distinguished by an out-turned rim and more drooping profile. It is confined to the Southern Sector and occurs occasionally throughout its occupation. It is invariably of a thick coarse greyish red fabric, which is rarely treated with slip.

Type 78 is a large jar-type characterized by thick ware and a heavy roll rim. It occasionally occurs in the post-Arretine phase of the Northern Sector and throughout the occupation of the Southern. It is invariably of a coarse greyish red fabric with grey core, and is treated with red slip on the exterior.

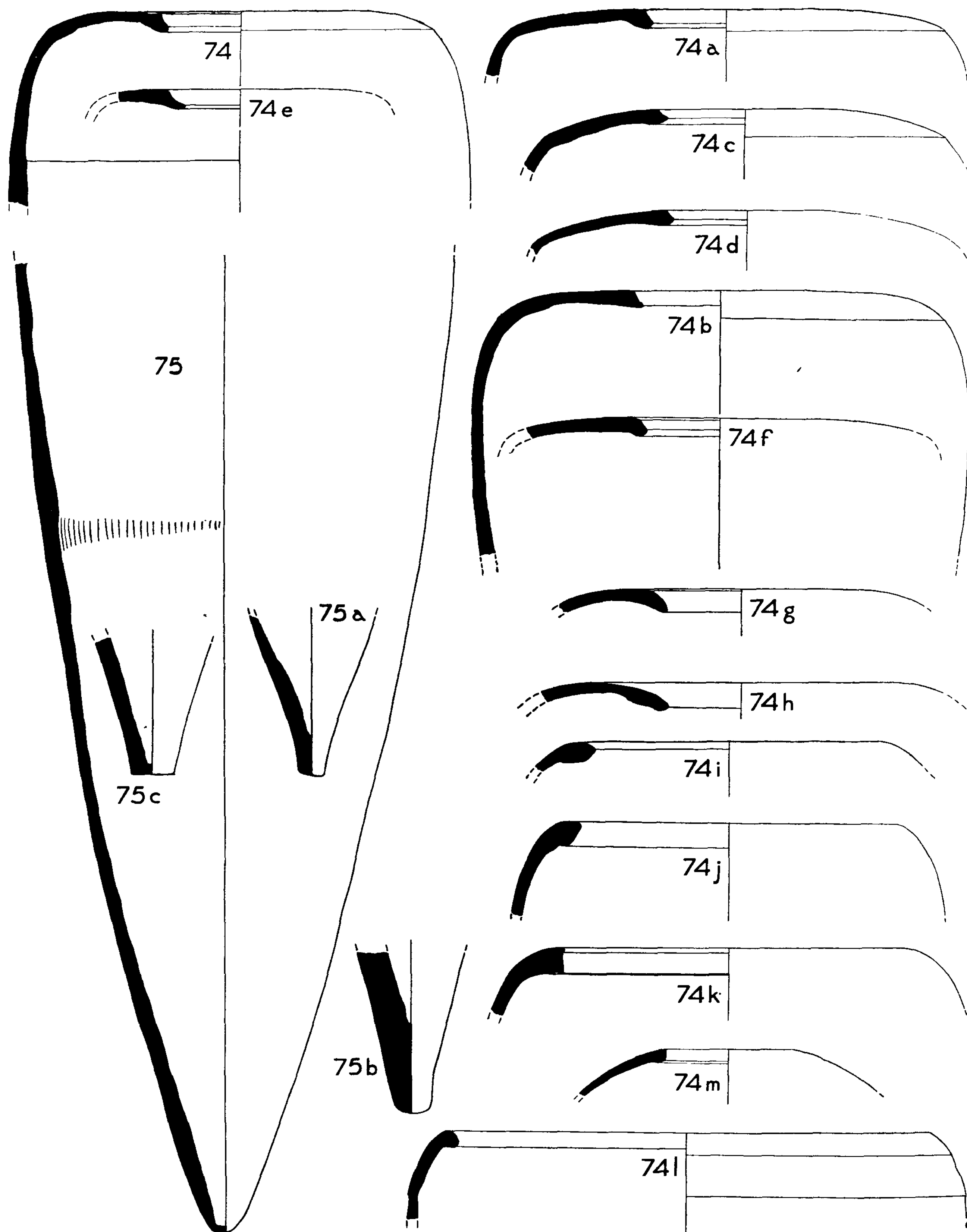


FIG. 29. *Types 74-75.* ¼

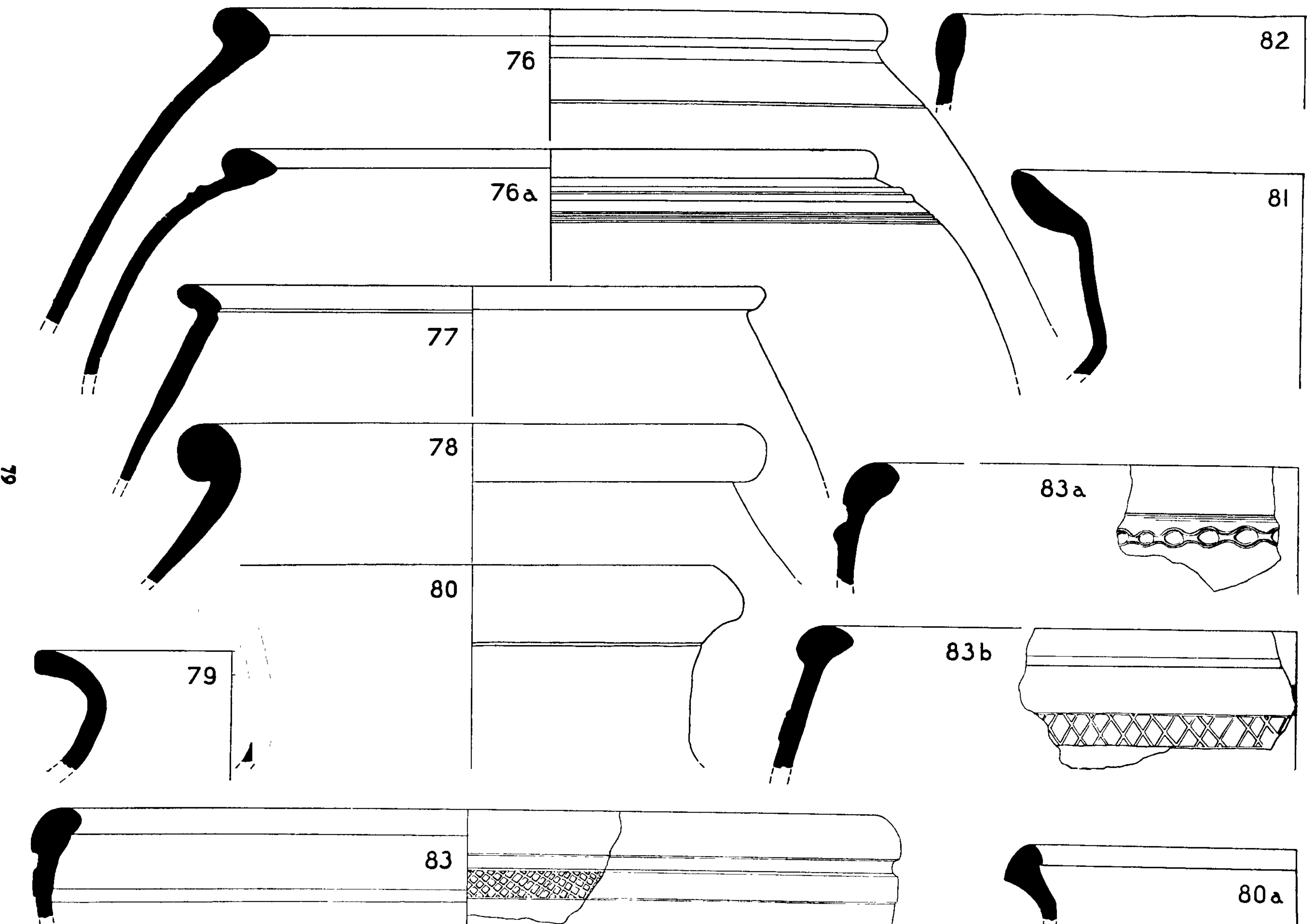


FIG. 30. *Types 76–83.* ¼

Type 79 is a unique jar-fragment with thick flaring rim. It is of gritty greyish red fabric and comes from a mixed deposit (AK VIII, pit 1).

Type 80 is very rare; it is a large jar with high neck and internally hollowed rim. It is of a thick light-red fabric, and occurs exclusively in the post-Arretine period of the Northern Sector. Variant 80*a*, which combines in its rim an external beak with an internal roll, is relatively more abundant than the arch-type but is represented only by minute fragments; it occurs occasionally in the post-Arretine period of the Northern and all phases of the Southern Sector. It is invariably of a micaceous gritty greyish buff ware.

Type 81 is a large jar with a high neck analogous with Type 80 but shows a different rim-form. It is represented by a solitary specimen of thick gritty grey ware from the post-Arretine phase of the Northern Sector.

Type 82 probably represents a large basin with a clubbed rim. It occurs occasionally throughout the occupation of both Sectors, and is of a thick coarse fabric treated with slip. It is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all phases of the Southern.

Type 83 apparently represents a somewhat similar vessel but is characterized by a raised ornamented band below a heavy rim. It occurs in fair quantity throughout the occupation of both Sectors. It is of a thick coarse fabric treated with slip, and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all phases of the Southern. Variants 83*a-b* share the range of fabric and distribution of the main type, from which they slightly deviate in shape. Like the arch-type, the variants also bear a band of decoration, which was either incised or impressed on an applied band of clay. The normal patterns are close cross-hatching as on the main type, large cross-hatching as on 83*b* and finger-tip ornament as on 83*a*.

Type 84 is a large basin with a clubbed rim and corrugated body. This is one of the principal basin-types and occurs throughout the occupation of both Sectors. It is of a thick coarse fabric, usually treated with slip on both faces, and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all phases of the Southern. Variant 84*a*, with sides tending to taper downward, is of a coarse grey fabric and occurs exclusively in the Arretine layers of the Northern Sector. Variant 84*b*, which has an almost straight side, shares the fabric of the arch-type and is occasionally found in all periods of both Sectors. The specimen illustrated has an individual feature in the band of slashed ornament below the rim.

Type 85 is a large shallow basin marked by an inconspicuous rim. This type is confined to the Southern Sector and occurs sporadically throughout its occupation. It is invariably of a coarse greyish red fabric treated with red slip on both sides. Variants 85*a-b* are exceptional in having handles, the former a loop-handle flanked by nail-like projections possibly copied from a metal prototype, the latter a lug-handle. While 85*a* is a fair-sized basin of coarse greyish buff ware from the pre-Arretine phase, 85*b* is a small basin of a coarse greyish red fabric from a mixed group of the Southern Sector.

Type 86 is a basin with a flaring rim. Like Type 85, it occurs exclusively in the Southern Sector and is of a coarse greyish red fabric treated with red slip on both faces. Variant 86*a* is a black-and-red ware basin from the Late Drain Phase of the Southern Sector, while 86*b* shares the fabric with the arch-type but has a slip only on the interior face and is peculiar to the post-Arretine period of the Northern Sector.

Type 87 is a basin distinguished by a simple incurved rim. This is a rare type, occurring sporadically throughout the occupation of both Sectors. It is of a coarse fabric and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all phases of the Southern. Variant 87*a*, with an internally expanded rim, is a unique example in red-slipped coarse greyish red ware from the Pre-structural Phase of the Southern Sector.

Type 88 is a normal type of basin, characterized by a clubbed rim. This type, together with variant 88*a*, occurs in fair quantity throughout the occupation of both Sectors. It is of a coarse fabric, usually treated with slip inside, and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all phases of the Southern. Variant 88*b*, with a heavy bead-rim, is confined to the post-Arretine period of the Northern Sector and all phases of the Southern and is invariably of a coarse greyish red ware. The specimen illustrated bears a large perforation.

Type 89 is a unique basin with a pronounced rim and angular shoulder. It is of a coarse greyish buff fabric with polished chalky slip on both faces, and comes from the post-Arretine phase of the Northern Sector.

Type 90 is a rare type of bowl, invariably of coarse greyish red ware. It is peculiar to the Main Drain Phase of the Southern Sector.

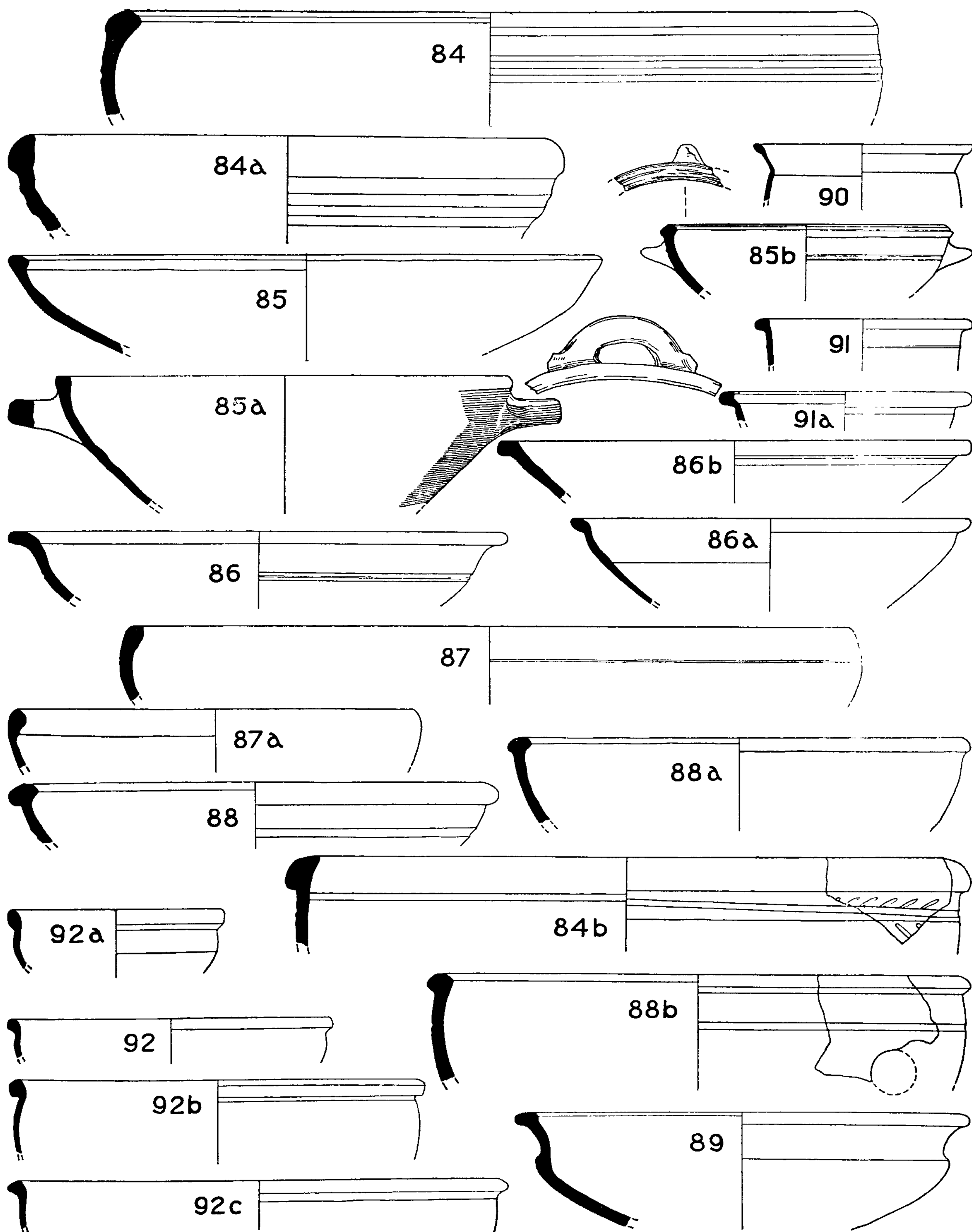


FIG. 31. *Types 84–92.* ¼

FIG. 32. *Type* 93. ¼

Type 91 is a bowl distinguished by an internally hollowed thick rim. It is characteristic of the Southern Sector and occasionally occurs throughout its occupation. It is invariably of a coarse greyish red fabric, with red slip inside. Variant 91*a* shares the fabric and provenance of the arch-type, from which it slightly deviates in shape.

Type 92 is a bowl with a thickened or rolled rim. It occurs in fair quantity in the post-Arretine phase of the Northern Sector and throughout the occupation of the Southern. It is normally of a red-slipped coarse greyish red fabric. Variant 92*a* shows a cavity in section where the rim has been rolled; it is from the Pre-structural Phase of the Southern Sector. Variants 92*b-c* share the fabric and provenance of the arch-type, from which they slightly deviate in rim-form.

Type 93 is the commonest shape of basin and is distinguished by a flanged rim like that of Type 21, wide mouth and rounded base. It is one of the characteristic shapes of Arikamedu and is found in profusion throughout the occupation of both Sectors. The type is of a coarse fabric, usually treated with slip both inside and out, and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all phases of the Southern. Variants 93*a–c* show very slight deviations in shape. Variant 93*d* is of a coarse reddish fabric and is a unique piece from the post-Arretine phase of the Northern Sector; it has a carinated shoulder, and is treated with pinkish chalky slip on both sides. Variant 93*f* with a thickened rim and 93*g–j* with curved rims occasionally occur throughout the occupation of both Sectors. Variants 93*e* and 93*m*, both of a red-slipped coarse greyish red fabric, are unique examples respectively from Pottery Group A (Early Phase) and the Pre-Structural Phase of the Southern Sector. The former has a grooved rim, while the latter shows a rim resembling a golf-club. Variants 93*k-l*, of a red-slipped coarse greyish red fabric, have distinctive hammer rims, the former being peculiar to the post-Arretine period of the Northern Sector and the latter to the Late Drain Phase of the Southern.

Type 94 is a large carinated basin with a distinctive grooved rim and ridges on the shoulder. It is of a coarse reddish grey fabric with a chalky wash, and occurs exclusively in the post-Arretine phase of the Northern Sector.

Type 95 is a large bowl with a thickened rim, almost straight side and sagger base. It occurs occasionally throughout the occupation of the Southern Sector and is invariably of a coarse greyish red fabric with red slip inside and out.

Type 96 represents a similar bowl but with a pronounced flat rim. Its fabric and distribution are identical with those of Type 95.

Type 97 is a bowl distinguished by a bulbous profile and pronounced bead-rim. It is one of the characteristic types of the site and occurs throughout the occupation of both Sectors. It is of a coarse fabric, treated with slip outside, and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all phases of the Southern. Variants 97*a–d* slightly deviate from the arch-type in shape, while 97*e* has the same profile as the arch-type but shows a clubbed rim and is confined to the Southern Sector through all phases of its occupation.

Type 98 is a larger bowl than Types 95–97 and is characterized by a thick out-turned rim and multi-ridged profile. It is rare but occurs sporadically in the Arretine and post-Arretine phases of the Northern Sector. It is invariably of a coarse greyish red fabric with red slip on both faces. Variant 98*a* has a more emphatic rim and is peculiar to the post-Arretine period.

Type 99 is a large bowl with an oblique rim. It is a rare type but occurs sporadically throughout the occupation of both Sectors. It is of a coarse fabric, treated with slip outside, and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all phases of the Southern. Variant 99*a* has a slightly more everted rim.

Type 100, with a concave upper profile and grooved shoulder, occurs exclusively in the Arretine layers of the Northern Sector and is invariably of a coarse grey fabric with polished brownish chalky slip inside and out.

Type 101 is a bowl characterized by an everted rim and a rounded profile and base. It is the principal type of bowl and is found throughout the occupation of both Sectors. It is of a coarse fabric, treated with a slip outside, and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all phases of the Southern.

Type 102 is the upper part of a small bowl with a flaring rim and straight side. This is a rare type, occurring sporadically throughout the occupation of both Sectors, and is invariably of a fine grey fabric with black slip.

Type 103 is a bowl with a thickened and out-turned rim. It is a rare type, occurring sporadically in the Arretine and post-Arretine phases of the Northern Sector and throughout the occupation of Southern. It is of a coarse fabric, treated with slip both inside and out, and is generally grey in the Arretine phase and red

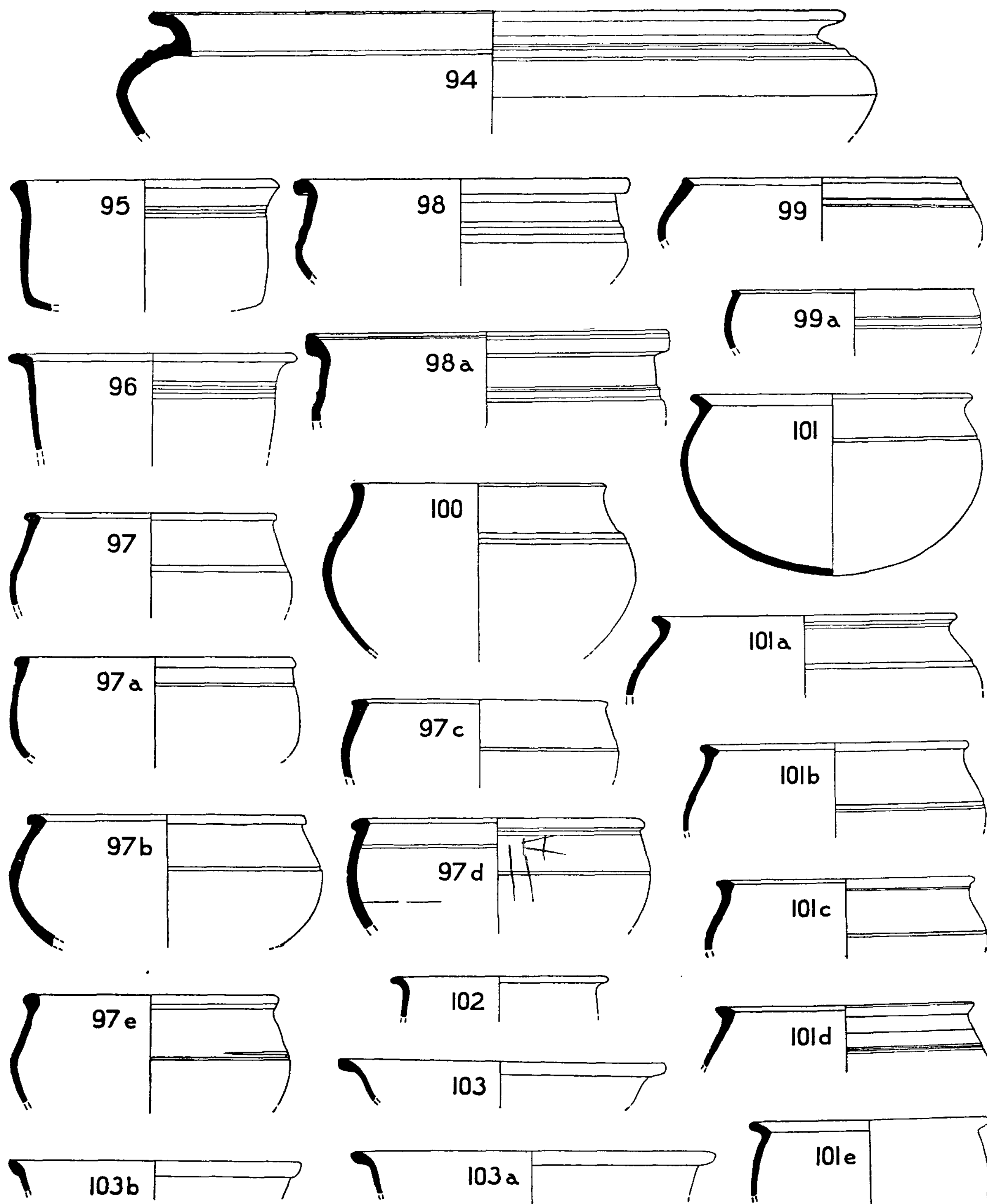


FIG. 33. *Types 94–103.* ¼

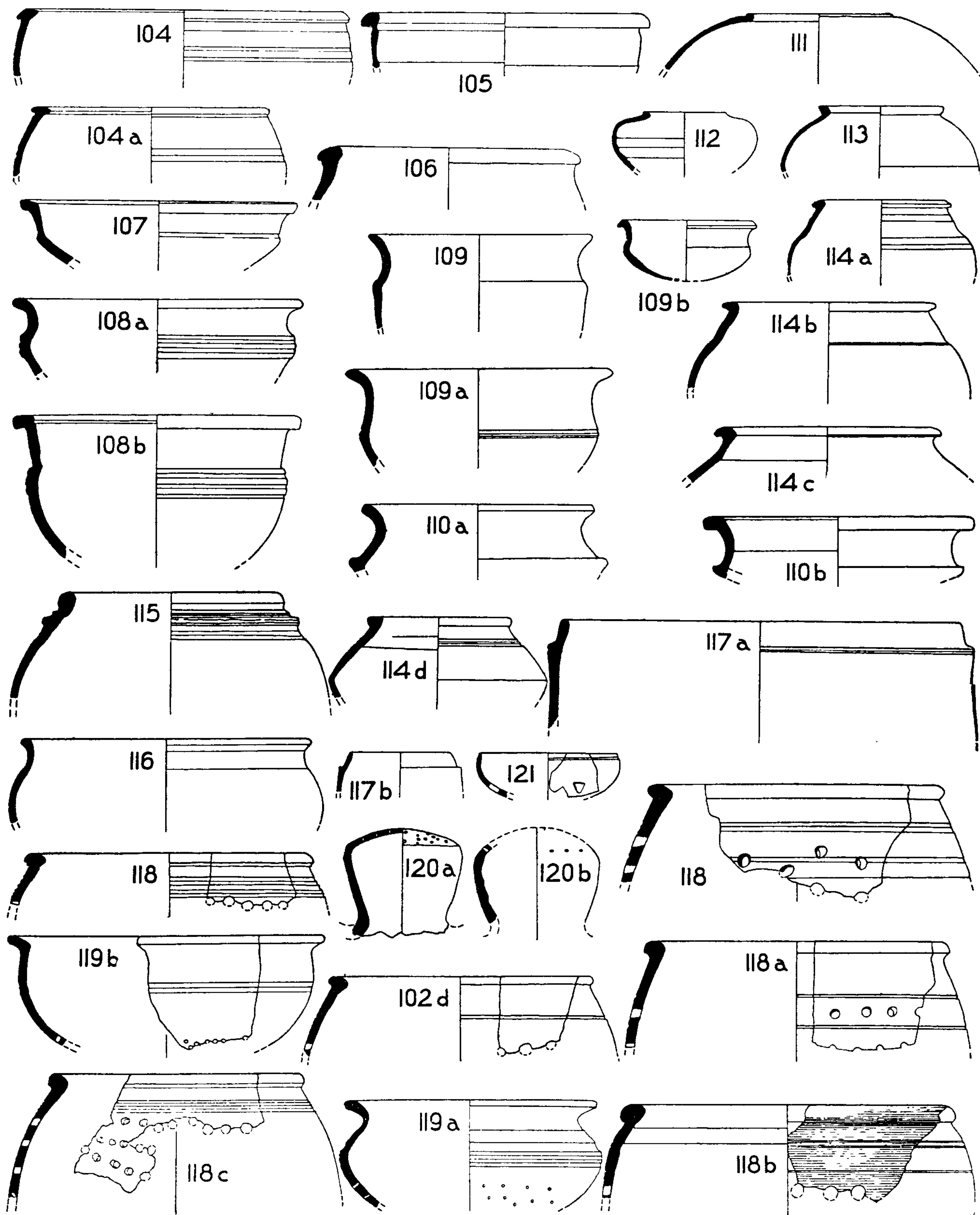


FIG. 34. *Types 104–121.* ¼

elsewhere. It also occurs in black ware or black-and-red ware (i.e. black inside and red outside) due obviously to differential firing.

Type 104 is a large bowl with a hammer-headed rim. It is one of the principal bowl-types and occurs throughout the occupation of both Sectors. It is of a coarse fabric, treated with slip, and is generally grey in the pre-Arretine and Arretine layers and red in the post-Arretine period of the Northern Sector and all phases of the Southern. Variant 104*a* has a more bulbous profile.

Type 105 is a rare type of bowl with a heavy rim. It is of red-slipped coarse greyish red ware and comes from the Early Phase of the Southern Sector, including Pottery Group A.

Type 106 is also a rare type, occurring sporadically throughout the occupation of both Sectors. Its fabric and range of distribution are similar to those of Type 104.

Type 107 is a bowl with an out-turned flattened rim and angular shoulder. It is a rare type, confined to the post-Arretine period of the Northern Sector, and is of a coarse greyish red fabric.

Type 108 is distinguished by a multi-ridged shoulder and is represented only by the two specimens, here illustrated. Its fabric and provenance are similar to those of Type 107.

Type 109 is a shouldered bowl with a high rim. It is of a coarse greyish red fabric and comes from a mixed deposit (AK VIII, pit 1). Variant 109*a* with an angular grooved body is unique; it is of a coarse grey fabric with chalky slip on both faces, and comes from the same mixed deposit. A tiny variant of 109*a*, of a coarse greyish red fabric, comes from an unstratified deposit (AK I) of the Southern Sector.

Type 110 is a bowl with a prominent flanged shoulder. It is represented by two specimens from the post-Arretine period of the Northern Sector.

Type 111 is the upper part of a small vessel with a beaded rim. The type is invariably of a coarse greyish red fabric and occurs occasionally in the post-Arretine period of the Northern Sector and relatively more frequently in the Southern Sector throughout its occupation. The shape of the lower part of the type is unknown, though the extant fragments bear partial resemblance to Types 74 and 112-13.

Type 112 is a tiny vessel of flat globular shape with a narrow mouth and beaded rim, somewhat analogous with Type 111, and of a coarse greyish red fabric. It is a rare type, but occurs sporadically in all phases of the Southern Sector.

Type 113, the upper part of a small globular vessel, is another rare type, occurring sporadically in the post-Arretine period of the Northern Sector and all phases of the Southern. It is of a coarse fabric, treated with slip outside, and is either greyish red or grey in the Northern Sector and greyish red elsewhere.

Type 114, a small vessel with an oblique rim, is also an extremely rare type, represented by four varying examples of a coarse grey or greyish red fabric, which are all illustrated. Variant 114*a* comes from the Late Phase of the Southern Sector, while variant 114*b*, of larger size, and 114*c*, with a more pronounced rim, belong to the post-Arretine period of the Northern Sector. Variant 114*d* has an angular profile, a flattened rim and grooved shoulder. It comes from an unstratified deposit of the Southern Sector.

Type 115 is a jar with a blunt rim and ridged shoulder. It is of coarse greyish red ware with red slip, and comes from an unstratified deposit of the Southern Sector.

Type 116 represents a bowl of coarse greyish red ware, occasionally found in the post-Arretine period of the Northern Sector and throughout the occupation of the Southern.

Type 117 is the upper part of a bowl with a rim rebated for receiving lid. Only two examples of this type are known, both made of a fine-grained pink fabric with red slip outside. Variant 117*a* is a large bowl with grey interior from a mixed deposit (AK VII, pit 2A), while 117*b* is a small brittle bowl from the post-Arretine phase of the Northern Sector.

Type 118 is the upper part of a fairly large perforated vessel with an open mouth, bluntly beaked rim and probably pear-shaped body. This type occurs sporadically throughout the occupation of both Sectors. It is of a coarse fabric and is generally greyish red in colour but is occasionally grey in the pre-Arretine and Arretine layers of the Northern Sector. Variants 118*a–e* illustrate the range of type. It is difficult to say what the function of these vessels was. That they were not heaters is clear from the absence of soot-stain on their exterior. It is likely that they were used as colanders or strainers.

Type 119 represents other perforated vessels, of which 119*a* is of chalky-slipped greyish buff ware resembling Type 24, and 119*b* is of chalky-slipped grey ware resembling Type 101. Variant 119*b* comes from the Arretine horizon (AK VIII, 5) of the Northern Sector.

Type 120 is a perforated vessel bearing partial affinity in shape to lid-types 34-35. It is represented by only two fragmentary examples, of which 120*a* is of a greyish buff fabric with pinkish chalky slip from the

unstratified French excavations, and 120*b* is black-slipped coarse grey ware from a pre-Arretine layer of the Northern Sector (AK V, 11A).

Type 121 is a unique haematite-slipped greyish red-ware bowl resembling Type 8*k*, with large triangular perforations in the base, and comes from the Late Drain Phase of the Southern Sector.

Type 122 is the upper part of a large jar decorated on the shoulder with two bands of alternating nicked and finger-tip pattern. It is of a coarse red fabric with a distinctive polished bright red slip outside and comes from the disturbed area of AK I in the Southern Sector. Variant 122*a* is of smaller size but has the same provenance. Similar ware distinguishes a fairly large class of vessels (comprising Types 123–34) characterized also by grooved rims.

Type 123 is the upper part of a unique ornamented *ghaṭa* (water-vessel) with an externally grooved rim. It bears on the shoulder a band of stamped concentric circles and another of incised oblique strokes. Its ware and provenance are similar to those of Type 122.

Type 124 is the upper part of a jar with a distinctive internally grooved and flanged rim. It is of a coarse greyish red fabric which is usually treated with bright red slip but in one case with yellowish red slip. It is a rare type, confined to the Late Drain and Late Phases of the Southern Sector. Variant 124*a* is represented by a solitary specimen from the post-Arretine phase of the Northern Sector.

Type 125 is the upper part of a large jar with a rim having one external and many internal grooves, which also occur on the exterior of the shoulder. It is of a coarse greyish red fabric, treated with red slip outside, and is represented by only two examples, of which one is unstratified, and the other comes from the Late Phase of the Southern Sector.

Type 126 is a pot with an angular profile and an externally grooved rim, represented by only two examples, one unstratified and the other from the Early Phase of the Southern Sector. It is of a coarse greyish red fabric painted with red slip outside. From their soot-stained exterior it is evident that these vessels functioned as cooking-vessels. Variant 126*a* with a rim thicker than that of the arch-type is a solitary fragment from the post-Arretine phase of the Northern Sector.

Type 127 is a carinated vessel with a grooved rim. It is of a fabric identical with that of Type 126. It occurs sporadically in the post-Arretine period of the Northern Sector and all phases of the Southern. Variant 127*a*, with a sharper carination, comes from an unstratified deposit, while 127*b* is represented by only two examples, one from a mixed deposit of the Northern Sector (AK II, pit 3) and the other from the Late Phase of the Southern.

Type 128 is the neck-fragment of a unique vessel with a broad rim having one external and numerous internal grooves. It is too fragmentary to show the shape of the body. It is of a coarse red fabric with burnished bright red slip and comes from the disturbed area of AK I in the Southern Sector.

Type 129 represents the fragmentary narrow neck of a jar with an externally grooved rim. It is a unique specimen from the Pre-structural Phase of the Southern Sector and is of a red-slipped coarse greyish red ware.

Type 130 is the fragmentary narrow neck of a jar with a rim having an internal and external groove. It is of a coarse greyish red fabric treated with red slip and occurs sporadically in the post-Arretine period of the Northern Sector and in unstratified deposits of the Southern.

Type 131 is a fragment of a unique jar with a grooved rim. It is of a red-slipped coarse greyish red fabric and comes from the post-Arretine period of the Northern Sector.

Type 132 represents the upper part of a unique bowl having an externally grooved rim. It is of a red-slipped coarse greyish red fabric and comes from the Early Phase of the Southern Sector.

Type 133 is the rim fragment of a jar showing an external groove. It is a unique piece, of light red ware, and comes from the Late Drain Phase of the Southern Sector.

Type 134 is the upper part of a jar with an externally grooved rim. From the fragmentary tapering profile it appears to have had a base resembling Type 138, but this possibility cannot be stressed. It is of a coarse greyish-red fabric with haematite slip, and comes from the post-Arretine phase of the Northern Sector.

Type 135 is the upper part of a jar with a profile similar to that of Type 134 but with a grooveless rim. Its shape is analogous with that of Type 118 which, however, belongs to the perforated class of vessels. It is of coarse greyish red ware with haematite slip, and occurs rarely in the post-Arretine period of the Northern Sector. The specimen illustrated has an individual feature in bearing an incised zigzag ornament.

Type 136 is the upper part of a basin decorated with two rows of incised zigzag below its thick hammer-head rim. It is a unique piece, in coarse greyish red ware, and comes from the Late Phase of the Southern Sector.

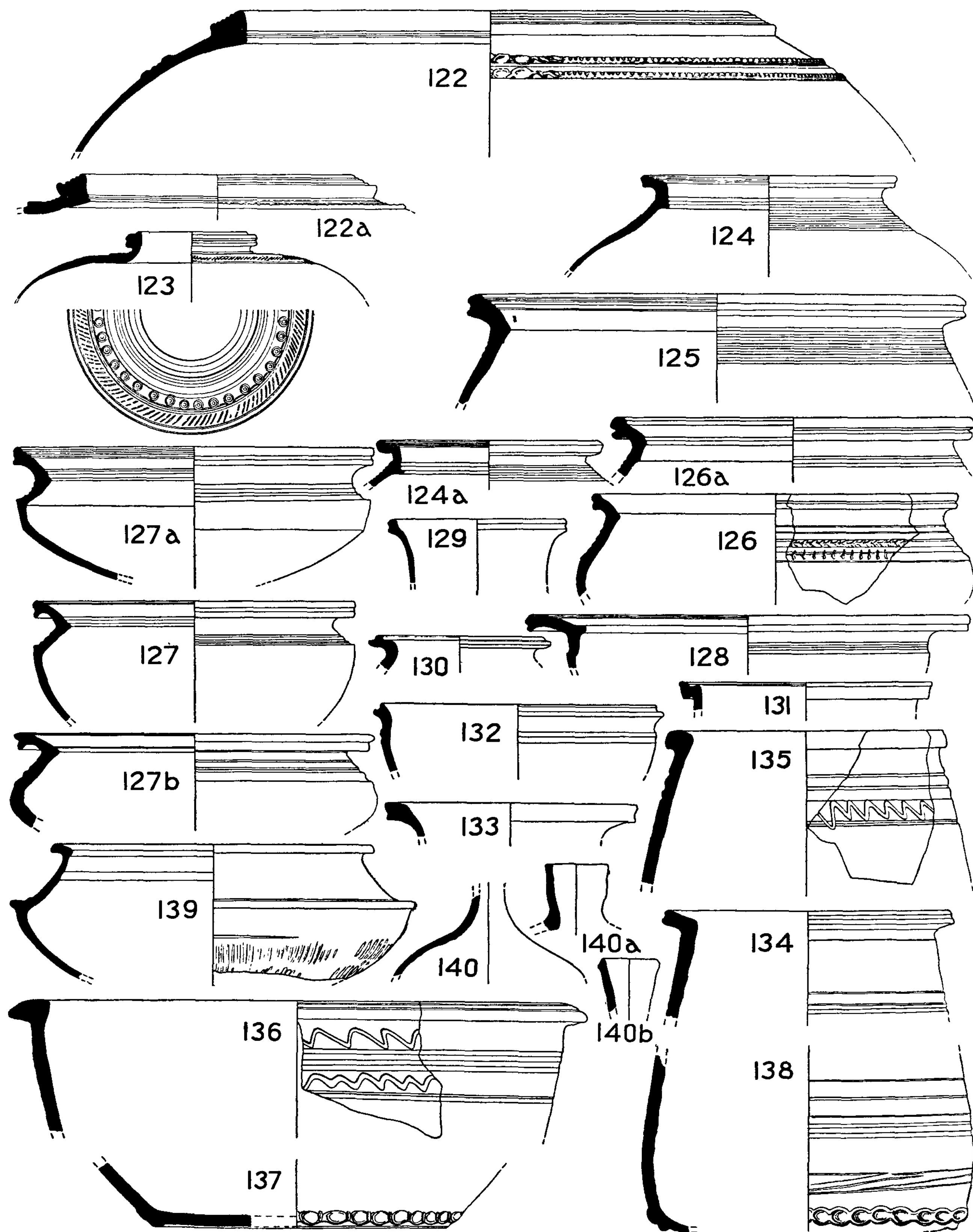


FIG. 35. *Types 122–140.* ¼

Type 137 is a fragment probably of a basin. It is of a gritty greyish red ware, and occurs rarely in the Late Phase of the Southern Sector. It invariably bears a row of applied finger-tip ornament just above the base.

Type 138 is the lower portion of a vessel possibly of Type 134. Like Type 137, it is of a gritty greyish red ware and always has a band of applied finger-tip ornament. It is a rare type, occurring sporadically in the Late Drain and Late Phases of the Southern Sector.

Type 139 represents a unique carinated vessel with a basket-impressed base. With a soot-stained exterior it was evidently a cooking vessel. It is of red-slipped thin light red ware and comes from Pottery Group A (Early Phase) of the Southern Sector.

Type 140 represents the upper part of a small bottle-necked vessel. It is a very rare type, confined to the pre-Arretine and Arretine layers of the Northern Sector. It is of a coarse fabric and occurs both in grey and red wares, the former being covered with bluish chalky slip and the latter with haematite slip. The actual bottle-neck is represented by 140*a-b*, the former coming from the pre-Arretine and the latter from the Arretine phase.

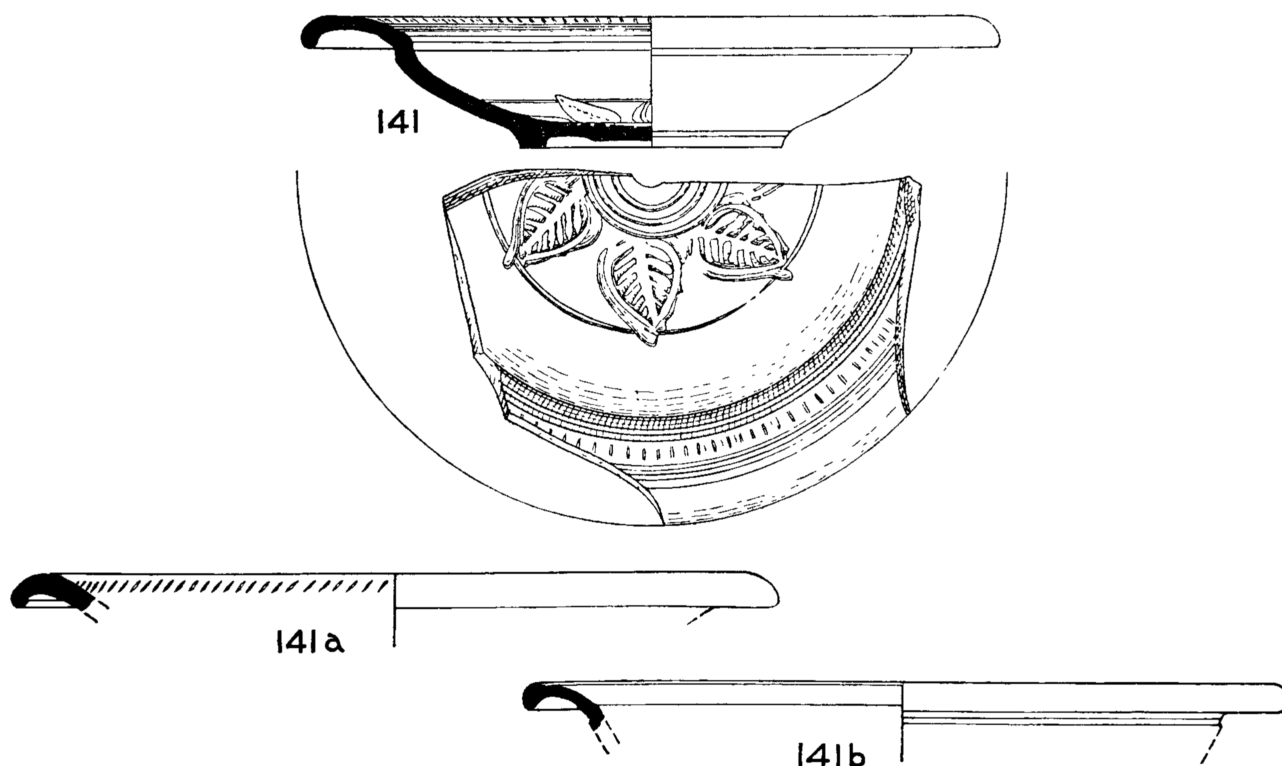


FIG. 36. *Type 141.* ½

Type 141 is a rare type of dish with a flaring rim and a foot-ring, and is ornamented on the interior face with a row of nicks at the rim and a stamped floral pattern on the base. It is of a fine grey fabric and occurs sporadically in the Arretine and post-Arretine layers of the Northern Sector and throughout the occupation of the Southern. Variant 141*a* comes from the Arretine layers, while 141*b* is peculiar to the post-Arretine phase of the Northern Sector.

Type 142 represents the hollow pedestal base of a pot, the full shape of which is unknown. It is invariably of coarse greyish red ware and occurs occasionally in the post-Arretine period of the Northern Sector and throughout the occupation of the Southern. The specimen illustrated has an individual feature in a row of slashed decoration both on the exterior and the interior and comes from Pottery Group A (Early Phase) of the Southern Sector. Variants 142*a-b* come from the post-Arretine phase of the Northern Sector, while 142*c* comes from a disturbed deposit of the Southern.

Type 143 apparently represents the bluntly pointed base of a large storage jar. It is of a thick coarse fabric, and occurs occasionally throughout the occupation of both Sectors. It is generally grey in the pre-Arretine

layers and red elsewhere. Variant 143*a* is confined to the post-Arretine period of the Northern Sector, while 143*b-c* are peculiar to the Southern Sector and occur occasionally through all its phases. Variant 143*d* is a unique specimen of a coarse grey fabric from the pre-Arretine phase of the Northern Sector.

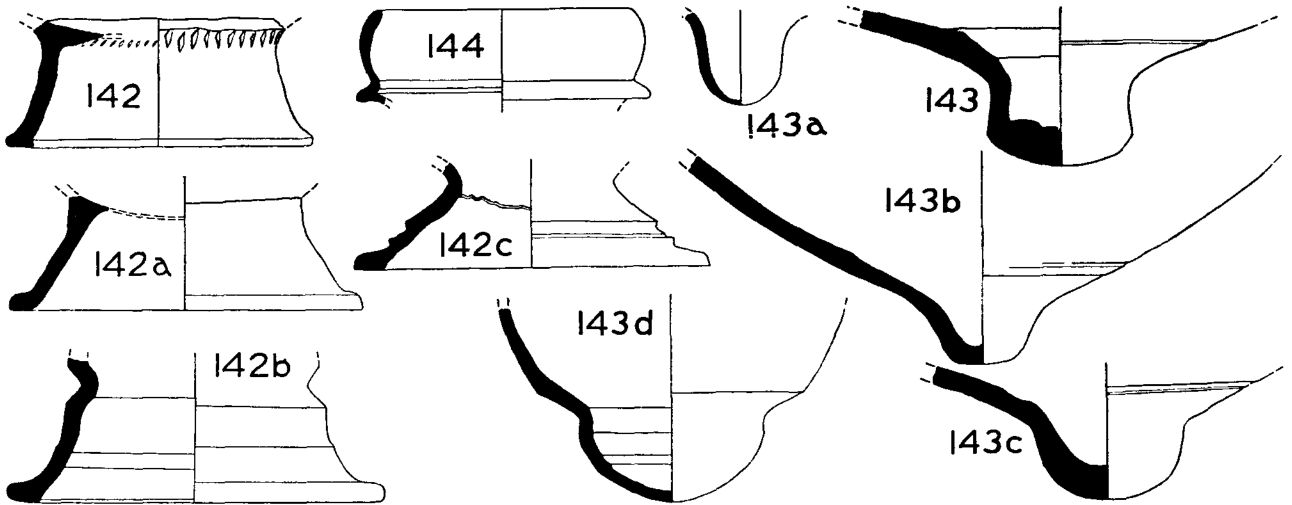


FIG. 37. *Types 142–144.* ¼

Type 144 represents the upper part of a unique vessel with a prominent flange below an incurved rim. It is of a coarse greyish buff fabric and comes from a mixed deposit of the Northern Sector (AK VIII, pit 1).

FRONT ELEVATION SIDE ELEVATION PLAN

FIG. 38. *Types 145–148.* ¼

Type 145 represents the top apparently of a large storage-jar. It is hand-made, of a thick coarse fabric which is generally grey in colour in the pre-Arretine and Arretine layers of the Northern Sector and greyish red elsewhere. It bears an applied band of finger-tip ornament. The type occurs throughout the occupation of both Sectors. In one instance the upper part of a vessel of this type was used as the top ring of a 'ring-well' or soak-pit.

Type 146 is a fragment probably of a finial, with numerous flanges. It is of a coarse fabric, generally grey in the pre-Arretine and Arretine layers of the Northern Sector and red elsewhere. The majority of its examples are made of two sections which are subsequently luted together, while a few (variant 146*a*) are potted in a single operation. It occurs occasionally throughout the occupation of both Sectors.

Type 147 is a cylindrical pipe of uncertain use. It is of coarse greyish buff ware, and occurs sporadically in the Arretine and post-Arretine phases of the Northern Sector.

Type 148 is a portable hand-made oven of horse-shoe plan. The type is invariably decorated with an applied band of finger-tip ornament on the exterior and a row of finger-nail impressions or punched circlets on the flanges of the opening. It is of a thick coarse fabric and is usually grey in the pre-Arretine and Arretine layers and greyish red in the post-Arretine period of the Northern Sector and throughout the occupation in the Southern. Normally it is of a crude workmanship but sometimes its exterior is smoothed and slipped.

C. Chinese celadon ware

Sherds of celadon ware can be picked up occasionally upon the surface of the site, and fourteen were found during the excavation. These occurred invariably in mixed deposits and spoil-trenches. It is likely that the numerous Coḷa coins, of the eleventh or adjacent centuries A.D., found previously should be ascribed to similar superficial deposits, as was a copper coin of this period found in 1945. Coins and pottery alike clearly relate, not to the occupation of the site, but to its spoliation in the middle ages.

The ware is greyish white in section but assumes a dull pink surface where (generally on the underside of the base) it has been exposed directly to the heat of the kiln. For the most part it is covered with a jade green glaze, usually crackled. (For chemical analysis, see below, p. 94.) The shapes, so far as they can be reconstructed, indicate bowls and dishes, all with foot-rings, to one of which sand adheres. The bowls are usually fluted or dimpled.

Celadon ware was made principally in the Chekiang province of China, notably at Yüeh Chou, Lung-Ch'üan and Ch'u Chou, where its kilns are known. It was already in production before the end of the T'ang dynasty (A.D. 618–906), but it is specially characteristic of the Sung and Yüan dynasties (A.D. 960–1368) when its manufacture centred first round Lung-Ch'üan and later round Ch'u Chou. Much of it was made specifically for foreign trade, and its distribution began before A.D. 883, the date of the abandonment of Samarra (on the Tigris), where typical Yüeh Chou wares, characterized by sand adhering to the foot-ring, have been found. This ware occurs in fair quantity also in the mounds of Fostat (Old Cairo).

The export trade in celadon became brisk in the Sung period (A.D. 960–1279) and reached its peak under the Yüan dynasty (A.D. 1280–1368). Plates of this ware have been found extensively over Asia and East Africa. It occurs, for example, in Persia at Rhages which was destroyed in A.D. 1256. In India, in addition to Arikamedu, it has been picked up at Brāhminābād in Sind and at Kayal on the banks of the Tāmraparṇī in the Tinnevelly District.

In the Yüan period (A.D. 1280–1368) the manufacture was extended to Siam, but the products of the Siamese kilns do not appear to have attained the standard or volume of the establishments in China.

The archaeological evidence is supported and supplemented by historical notices. Albirūnī (A.D. 973–1048) refers to the export of these wares to India, Ceylon and Persia.

Salādīn of Egypt is said to have made a gift of several examples to Nūr-e-dīn, Sulṭān of Damascus, A.D. 1171. Marco Polo (A.D. 1288) describes the route of their export from the Chinese port of Ch'u Chou by way of Cochin China and Sumatra to Martaban in Burma,[1] whence it was transhipped to Ceylon and to Coilam or Quilon (Malābār Coast), Gujarāt, Cambay and Mālwā in India, and across the ocean to Zanzibar. The ware was in great demand throughout the ancient orient as much for its supposed medicinal properties as for its aesthetic quality.

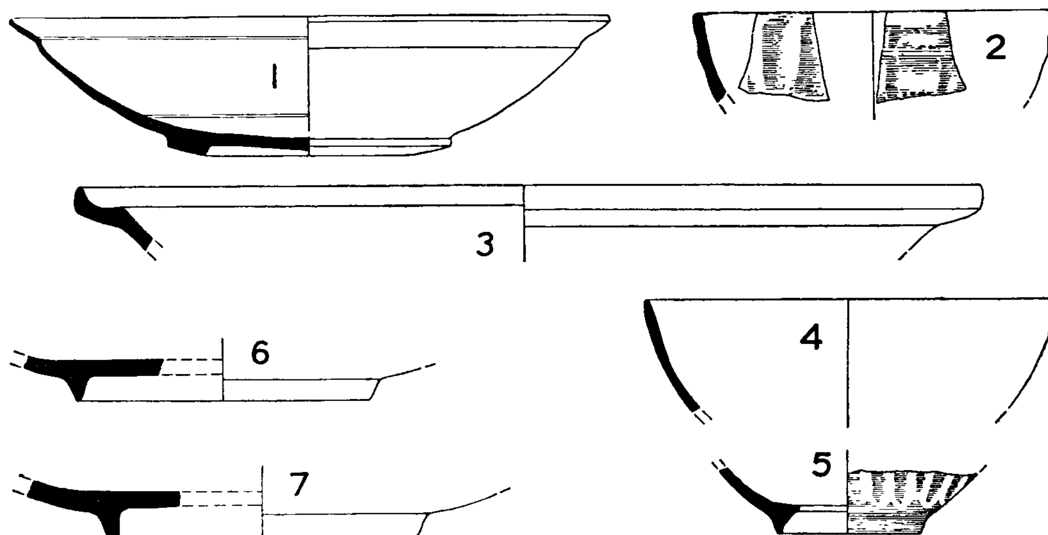


FIG. 39. *Chinese celadon ware.* $\frac{1}{3}$

The reference to Coilam or Quilon on the Malābār Coast as a port of call assumes added significance in the light of allusions to this coastal town as a medieval settlement of Chinese merchants.[2] The discovery of celadon at Arikamedu shows that the eastern coast of India not unnaturally had also ports of call for ships engaged in the China trade.

The celadon wares found at Arikamedu have all the characteristics of the Sung and Yüan Lung-Ch'üan wares meant for export trade. As the plain wares are earlier in date than the decorated ones, the Arikamedu specimens (which are invariably plain) may perhaps be ascribed to *circa* tenth–twelfth centuries A.D. An early date is also suggested by the recovery here of a fragment of a typical Yüeh foot-ring with sand adhering to it.

The following examples of this ware from Arikamedu are here illustrated (fig. 39) :—

1. Bowl of thin fabric, from the unstratified French excavations.
2. Rim of a bowl with fluted and ridged body. From a sandy layer immediately underlying a 'spoil-trench' in the Northern Sector (AK VI).
3. Fragment of a dish with hollowed rim for receiving a lid. From an unstratified deposit of the Southern Sector (AK I).
4. Fragment of a plain bowl. From a superficial deposit of the Southern Sector.
5. Base of fluted bowl with foot-ring. From a spoil-trench of the Southern Sector.

6-7. Fragments of thick-walled dishes showing foot-ring. From an unstratified deposit of the Southern Sector (AK I).

[1] The transhipment at Martaban was responsible for the popular Persian designation of this ware as *Martabanī*.

[2] See K. P. P. Menon, *History of Kerala*, ed. by T. K. Krishna Menon (Cochin Government Press), I (1924), 270ff.

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D. ADDENDA TO THE POTTERY

(i) *Comparison of the Arikamedu pottery with North Indian wares*

Although the available evidence for comparison is at present far from extensive, a provisional comparison may be offered between the Arikamedu pottery and that of a few approximately contemporary sites in northern India. The northern sites in question are Taxila (Punjab), Ahichchhatra (U.P.) and Maholi (U.P., near Mathurā).

The comparison reveals very few affinities between the northern and the southern series. The general run of the southern wares is of somewhat coarser fabric than the northern, a difference due in part, perhaps, to the varying qualities of the clay, but emphasized in the South by a generally less sophisticated range in design. Even utilitarian devices such as spouts, handles and pinched lips are very rare at Arikamedu, although fairly abundant in the North.

Two or three types, however, appear to indicate a certain elementary community of tradition between the two regions. The dishes with convex bases and incurved sides, grouped as Type 2 both at Arikamedu and at Ahichchhatra (*Ancient India*, No. 1, p. 45), show a resemblance not merely in form but sometimes also in fabric; and, although the type is not highly specialized, it is possible that the Arikamedu series represents the culmination of a widespread form which, in the North, goes back at least to the fourth century B.C. On the other hand, the very highly polished fabric used for some of the northern dishes and christened Northern Black Polished Ware (ib. p. 55) is not found in the South. The nearest approach to it at Arikamedu is the occasional use of a magnetic lustre (see pp. 51, 94), but this is very rare and constitutes a different technique. Possibly a more significant analogy is presented by the Arikamedu Type 12, which is identical with Ahichchhatra Type 29 (dated A.D. 100–350) and a Kushāna type at Maholi (*Journ. U.P. Hist. Soc.*, XV, 1940, pl. 1); but this type has a wide range in time and space in India and must not be held to imply close cultural or other links. The same reservation applies to Arikamedu Type 12*a*, which resembles a type found at Taxila (Sirkap) and there datable presumably to the first centuries B.C.–A.D.

(ii) *Chemist's notes*[1]

Salt-glazing (see above, pp. 50, 51, 52, 55)

Several specimens of pottery found at Arikamedu in the (earlier) Northern Sector are glazed, showing the characteristic crackled surface or 'crazing' under the microscope. The coating of glaze, however, does not stand out as a distinct layer, and the glazed effect is only superficial. It is therefore highly probable that these specimens were salt-glazed. In the process of firing, when the fuel has almost burnt out in the kiln and the pots are still red-hot, moist salt is thrown into the kiln. Under the intense heat the salt volatilizes and, by reacting chemically on the surface of the pots, produces the glaze.

[1] Supplied by the Chemist of the Archaeological Survey of India.

Black slip with lustrous finish (see above, p. 51)

A few potsherds, confined to the pre-Arretine and the lowest Arretine layers of the Northern Sector, show a black slip with a striking metallic lustre. The particles of the black film are magnetic, and chemical analysis shows that the black substance consists largely of magnetic oxide of iron, which is black in colour. There is no doubt that amorphous carbon in the form of soot or smoke also contributes to the black colour. Graphitic carbon is absent. The black substance on the other potsherds sent for comparison from the same site is not magnetic, and thus the difference in lustre and tint must be attributed to the finely divided magnetic oxide of iron. The presence of soot indicates that a smoky fire was used for baking the ware at a moderate temperature. On removing the shiny film a dull black surface is exposed. This black is due to the penetration of fine particles of carbon into the pores of the sherd, and also to the presence of iron in the ferrous condition. It appears that a slip of ferruginous clay was applied to the ware and it was then baked at a moderate temperature in a smoky fire.

Haematite slip

A polished bright red slip is occasionally found at Arikamedu in all periods and is identified as haematite. At ordinary temperatures the following oxides of iron are known to have a deep red to light red colour:—

(1) Anhydrous sesqui oxide of iron, known as haematite. This does not contain any chemically combined water;
(2) Hydrated oxide of iron, known as limonite;
(3) Hydrated oxide of iron, known as goethite.

Nos. 2 and 3, natural hydrated ferric oxides, have 9·9 to 13·2% of water of hydration. This chemically combined water is driven off by heating the oxides to dull red heat. Dehydration experiments on goethite at different temperatures show that its complete dehydration and conversion into haematite take place at about 380°C. Furthermore, the finer the grain-size, the faster the dehydration. It is clear, therefore, that whatever be the form of the oxide present in the original slip, baking at 600–700°C. would convert it into anhydrous sesqui oxide of iron or haematite. During the operation of firing, any water present in the oxide of iron will be completely driven off because the temperature of the kiln is likely to be much higher than the dehydration-temperature of the oxide. The presence of goethite or any other hydrated oxide of iron must be ruled out in view of these facts. In order to settle the point, however, surface scrapings of the red slip were heated to dull red heat (700°-800°C.) and loss in weight determined. The loss in weight was inappreciable, whereas if the red material were goethite or limonite, roughly a loss of 10% should have been observed. There is, therefore, no doubt that the red substance present as slip is anhydrous sesqui oxide of iron or haematite.

It is clear from the above that there is no means of finding out whether the original slip was powdered goethite or haematite, for, even if goethite were used in the slip originally, the temperature required for baking and glazing would be sufficiently high for its complete dehydration and conversion into haematite.

Chinese celadon ware (above, p. 91)

The composition of the body of the sample submitted is given below:—

SiO_2	73·67%
Al_2O_3	19·15%
Fe_2O_3	1·41%
FeO	2·43%
CaO	3·27%
MgO	1·02%
MnO	in traces
Alkalies	in traces
TOTAL	100·95

Copper, lead, cobalt and phosphate are absent. The body is dense and greyish green in colour.

Chemical analysis of the sample shows that the colour of the body is due to iron compounds. A very high temperature must have been used for firing and porcelainizing the clay. Microscopic examination of the body,

however, shows that vitrification is very imperfect and coarse grains of quartz and iron oxide are occasionally observed. Next, the analysis of the body and the glaze was undertaken. This course had to be adopted because very minute quantities were involved and the marked hardness of the sample made it difficult to separate the glaze completely from the body. The results of quantitative analysis are as follows:—

SiO_2	72·32%
Al_2O_3	19·27%
Fe_2O_3	1·91%
FeO	2·20%
CaO	3·99%
MgO	0·89%
MnO	traces
Alkalies	traces
TOTAL ..	100·58

The sample is free from copper, lead, cobalt and phosphate.

The above analysis leads to the conclusion that the greyish green colour of the glaze is due to the presence of ferrous iron. The compound which imparts the characteristic colour to the glaze may be a ferrous silicate or a solid solution of oxide in the complex alumino-silicates present. The results, however, leave no doubt as to the technique of the glazing. When the two analyses are compared, it becomes evident that the compositions of the glaze and the body are quite similar. This accounts for the remarkable freedom of the glaze from 'crazing' or 'crackling'. 'Crazing' is primarily due to difference in the dilatability of the body and the glaze when exposed to changes in temperature. When the body and the glaze are similar in chemical composition, there is little difference in the rate of expansion and the glaze may not show any 'crazing'. When, however, there is a wide divergence in the rate of expansion owing to difference in chemical composition, the glaze is often crackled or crazed. The body and the glaze seem to have been fired in one operation.

The presence of a large number of bubbles or spherulites in the glazed surface, as shown by the microscope, suggests that the glazing was imperfect owing to incomplete vitrification of the constituents of the glaze. Its freedom from alkalies and lead would require a very high temperature of firing for complete vitrification, when the easily fusible ferrous silicates and complex iron-alumino-silicates would combine with the more refractory clay and produce the glaze. An application of extremely finely levigated ferruginous clay to the dried ware of the same type of clay, followed by drying and polishing to level the coating, and subsequent firing at a very high temperature in a reducing atmosphere, would be the necessary condition for the formation of the glazed ware under investigation.

5. OTHER SMALL FINDS

The chronological scheme into which the other small finds (equally with the pottery) are fitted has been detailed above, p. 50. Finds from strata, mostly late, which could not be equated with any building-period or significant sequence, together with those from AK I, a much disturbed site in the Southern Sector, are grouped as 'unstratified'.

E. BEADS

More than two hundred beads of various materials were found in the excavations, besides a number of unfinished ones and fragments of semi-precious stones doubtless intended for the industry. It is evident that beads were manufactured on a large scale at Arikamedu.[1]

[1] Besides the semi-precious stones mentioned below, several pieces of obsidian and green jasper have also been found, together with much glass-slag.

The materials used for the manufacture of beads fall under the following heads:—

Semi-precious stones: (*a*) Chalcedonic quartz, including agate and carnelian. (*b*) Crystalline quartz, including crystal and amethyst.
Shell.
Bone.
Gold.
Terracotta.
Faïence.
Glass.

Of the semi-precious stones, amethyst and carnelian account for ten beads each, crystalline quartz eight, and agate, banded or plain, four. Though amethyst occurs even in the post-Arretine deposits in the Northern Sector there is only one specimen of it in the Southern Sector, found in mixed soil a few inches below the surface. It is therefore possible that the stone fell into disuse as a bead-making material in the latter part of the life of the town.

Carnelian is distributed in all the periods with a fair uniformity. Agate and quartz-crystal are absent in the pre-Arretine and Arretine strata of the Northern Sector. Whether this phenomenon is due to their late appearance as a bead-making material in this part of the country or to the limited area in which the pre-Arretine and Arretine strata were touched cannot be said.

Shell, on the other hand, is not represented in the collection from the Southern Sector, though thirteen shell beads were found distributed at all levels in the Northern. This again may be an accidental feature, as the fishing of shell is a long-established industry on the southern coast of India. Bone beads are rare, there being only two specimens, one each from the Arretine and the post-Arretine levels in the Northern Sector.

Three gold beads have been found at Arikamedu:—

1. From an Arretine-producing layer (AK II, 8A) of the Northern Sector: barrel-shaped in elevation and scalloped or fluted in cross-section. Comparable with fluted gold beads from Taxila (Bhir Mound), dated to the end of the fourth century B.C.,[1] but the type is of much earlier origin, occurring, for example, in the temple of E-anna at Uruk at the end of the third millennium B.C. (Iraq Museum, Baghdad). Fig. 41, 40; pl. XXXIVA, 1.
2. From a post-Arretine deposit of the same Sector (AK II, 4): short-barrel circular. Fig. 41, 41; pl. XXXIVA, 2.
3. From the previous excavations, and now in the Pondicherry Bibliothéque: long-barrel circular. Pl. XXXIVA, 3.

Faïence is rare, being represented by one bead from a post-Arretine layer in the Northern Sector, and another from near the surface in the Southern.

There are sixteen terracotta beads from all levels of both the Sectors. They show little variation of shape, being always either pear-shaped or spherical: the latter are found only in the Southern Sector, along with the pear-shaped ones. These objects are very common on all ancient sites and have often been described as spindle-whorls, which indeed some of the larger specimens may have been.

A majority of the beads is made of glass. The range of colour is limited: shades of blue and green are the most popular colours throughout, followed by copper-red; less common colours being white and black, whilst yellow, violet, brown and grey are rarely represented. The material is generally opaque but sometimes translucent; transparent glass

[1] *Ancient India*, No. 1 (1946), p. 32.

is absent. A few very tiny glass beads, spherical or spheroid in shape, have been found in all periods of the site.[1] Some glass beads from the later strata in the Southern Sector are misshaped in manufacture. (Cf. fig. 40, 33 and 34.)

The range of bead-shapes is not very large, nor can it be affirmed that any particular shape, unless possibly the lug-collared type (see below), was restricted to any period or material. The main shapes represented are: spherical, spheroid, pear-shaped, cylindrical, barrel, truncated bicone, oblate and collared. Some of them may be divided into sub-types, such as circular, square, hexagonal, etc., according to their cross-sections.[2]

The spherical and spheroid shapes continued to be the most common throughout the occupation of the town. The more specialized shapes may also be said to have continued generally throughout. It is true that the shapes represented in the pre-Arretine and Arretine periods are much more limited in number than in the later periods, but this is probably due to the relatively small area in which these levels were excavated. On the whole, it may be held that there is no marked disappearance of old shapes or sudden emergence of new ones in the later periods.

The only possible exception to these generalizations is presented by a class of beads known as 'collared' beads, which are generally barrel-shaped in elevation with an attachment at either end. These attachments may be inconspicuous, being merely formed by shallow incisions near the ends which hardly disturb the profile of the bead, or may be in the form of prominent lugs. The class may thus be divided into 'groove-collared' and 'lug-collared'. Of the five groove-collared beads in the present collection, one each comes from the pre-Arretine, Arretine and post-Arretine deposits of the Northern Sector; the fourth and fifth ones are from the Southern Sector, found very near the surface, and are of no stratigraphic consequence. The lug-collared beads first make their appearance in the 'Arretine' period (first half of first century A.D.), and continue throughout the post-Arretine layers of the Northern Sector to the latest period of the Southern (second century A.D.). A conclusion may be hazarded that on this site the groove-collared beads antedate the lug-collared ones, but the inference must be checked by a study of this class of beads from other stratified sites. The Pondicherry Bibliothéque contains three new types of collared beads found previously at Arikamedu, besides those found in the present excavations: (1) a barrel roughly elliptical groove-collared bead of amethyst (fig. 41, 50); (2) a barrel plano-convex lug-collared bead of glass (fig. 41, 57); and (3) a cornerless cube lug-collared bead of amethyst (fig. 41, 58).

Collared beads have a very wide distribution in India and outside. In India, apart from a sort of prototype at Mohenjodaro (third millennium B.C.),[3] they are known to occur at Chandravalli (Mysore State) in a stratum which produced two denarii of Tiberius (died A.D. 37), Koṇḍāpur and Māski (Hyderabad State) in strata said to be of the Āndhra period, Śiśupāl near Bhubaneswar (Orissa), Kauśāmbī (United Provinces), Pāṭaliputra (Bihar), Durgāpur (Bengal), and in both the two city-sites, Bhir Mound and Sirkap, at Taxila (Punjab).[4] As the chronology of Taxila has been fixed with fair accuracy, it may be helpful to analyze the

[1] The three smallest ones measure ·05, ·06 and ·08 inch respectively.

[2] The method of classification adopted here is that of H. Beck, 'Classification and Nomenclature of Beads and Pendants', *Archaeologia*, LXXVII (1928), 1ff., and is as follows: Hold a bead with its hole in the horizontal position and parallel to the eye. The elevation thus obtained is its primary shape. The cross-section through its centre, cutting the hole at right angles, gives its secondary shape.

[3] J. Marshall, *Mohenjodaro and the Indus Civilization* (1931), III, pl. CXLIX, fig. 5.

[4] In the Durgāpur collection of Mr. Ajit Kumar Mukerji, there are two collared beads, one of each variety. In all other cases the lug-collared type is predominant, though the other type is not unknown. These details are derived from the drawings of Chandravalli beads kindly supplied by the Director of Archaeology, Mysore; photographs of Koṇḍāpur and Māski beads by the Superintendent of Archaeology, Hyderabad; and drawings

occurrence of these beads there. The Bhir Mound, believed to have been deserted in the second century B.C. after an existence of about three hundred years, yielded five groove-collared and three lug-collared beads; while Sirkap, which had been founded at the time of the desertion of the Bhir Mound and continued in occupation until the end of the first or beginning of the second century A.D., yielded only one groove-collared and seven lug-collared beads. One more lug-collared bead comes from Jauliān, a late monastic settlement. The priority of the groove-collared beads over the lug-collared ones is therefore fairly established at Taxila; but the occurrence of the latter in the Bhir Mound suggests that it was a known type by the second century B.C.

Outside India, collared beads at Gezer in Palestine have been dated B.C. 1000–500.[1] Ribbed gold beads with a collar at each end have been found in late Mycenaean tombs at Enkomi and Curium in Cyprus.[2] Collared beads have also been produced from other graves in Cyprus dated to the first half of the sixth century B.C.[3] Beck illustrates one groove-collared bead from Ur (before B.C. 600) and three lug-collared ones from Egypt (XIIth Dynasty), Praeneste (B.C. 800) and Cumae (B.C. 500) respectively.[4]

In the Pondicherry Bibliothéque are the following shapes, derived from the previous explorations but not represented in those of 1945:—

(1) A short-barrel gadrooned bead of carnelian comparable with the gold bead, fig. 41, 41, and pl. XXXIVA, 1, and doubtless derived from a metal prototype (fig. 41, 61); (2) a barrel (almost plano-convex) tabular bead of banded agate (fig. 41, 59); (3) an eye-bead of banded agate (fig. 41, 63); (4) a double-eye bead of the same material (fig. 41, 62); and (5) a frog-bead of light green glass[5] (fig. 41, 60).

List of selected beads (figs. 40-41)

1. Carnelian: spherical. Unstratified. (AK IV-206.)
2. Glass: spheroid. Unstratified. (AK IV-99.)
3. Glass: spheroid. Unstratified. (AK I-188.)
4. Glass: spheroid. Arretine. (AK II-244.)
5. Glass: spheroid. Arretine. (AK II-275.)
6. Glass: spheroid. Arretine. (AK II-459.)
7. Glass: spheroid. Post-Arretine. (AK VI-13.)
8. Glass: spheroid. Unstratified. (AK I-97.)
9. Glass: spheroid. Post-Arretine. (AK II-10.)
10. Shell: spheroid. Post-Arretine. (AK II-389.)
11. Glass: truncated bicone circular. Post-Arretine. (AK II-501.)
12. Glass: truncated bicone circular. Post-Arretine. (AK II-406.)
12A. Glass: truncated bicone circular. Unstratified. (AK IV-294.)
13. Glass: short-oblate circular. Post-Arretine. (AK II-463.)
14. Glass: short-oblate circular. Post-Arretine. (AK V-106.)
15. Glass: short-oblate circular. Arretine. (AK II-407.)
16. Glass: barrel circular. Arretine. (AK II-407A.)
17. Glass: barrel circular. Arretine. (AK II-401.)
18. Glass: barrel elliptical. Post-Arretine. (AK VII-17.)
19. Faïence: long-barrel circular. Post-Arretine. (AK III-37.)

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of Kauśāmbī and Pāṭaliputra beads in the Patna Museum and photographs of Durgāpur beads by the Superintendents, Archaeological Survey of India, Central and Eastern Circles respectively.

[1] R. A. S. Macalister, *The Excavation of Gezer* (1912), II, p. 112, and III, pl. CXXXVII, 60.

[2] Murray Smith and Walters, *Excavations in Cyprus* (Brit. Mus., 1900), pp. 65, 81 and pls. VIII and XIII.

[3] Ohnefalsch-Richter, *Kypros, the Bible and Homer* (1893), pls. LXVII, 7; CXLIV, 2 and 5; and possibly pl. XXV, 7, and p. 208, fig. 170.

[4] H. Beck, *op. cit.*, p. 15, fig. 16; p. 4, fig. 8; p. 15, fig. 16; and p. 67, fig. 74.

[5] Frog-beads have been found also at Taxila. H. Beck, 'The Beads from Taxila', *Memoir of the Archaeological Survey of India*, No. 65 (1941), pl. VII. They also occur at Kauśāmbī (U.P.); specimens in the Allahabad Museum. For eye-beads, see Beck, *op. cit.*, pl. I.

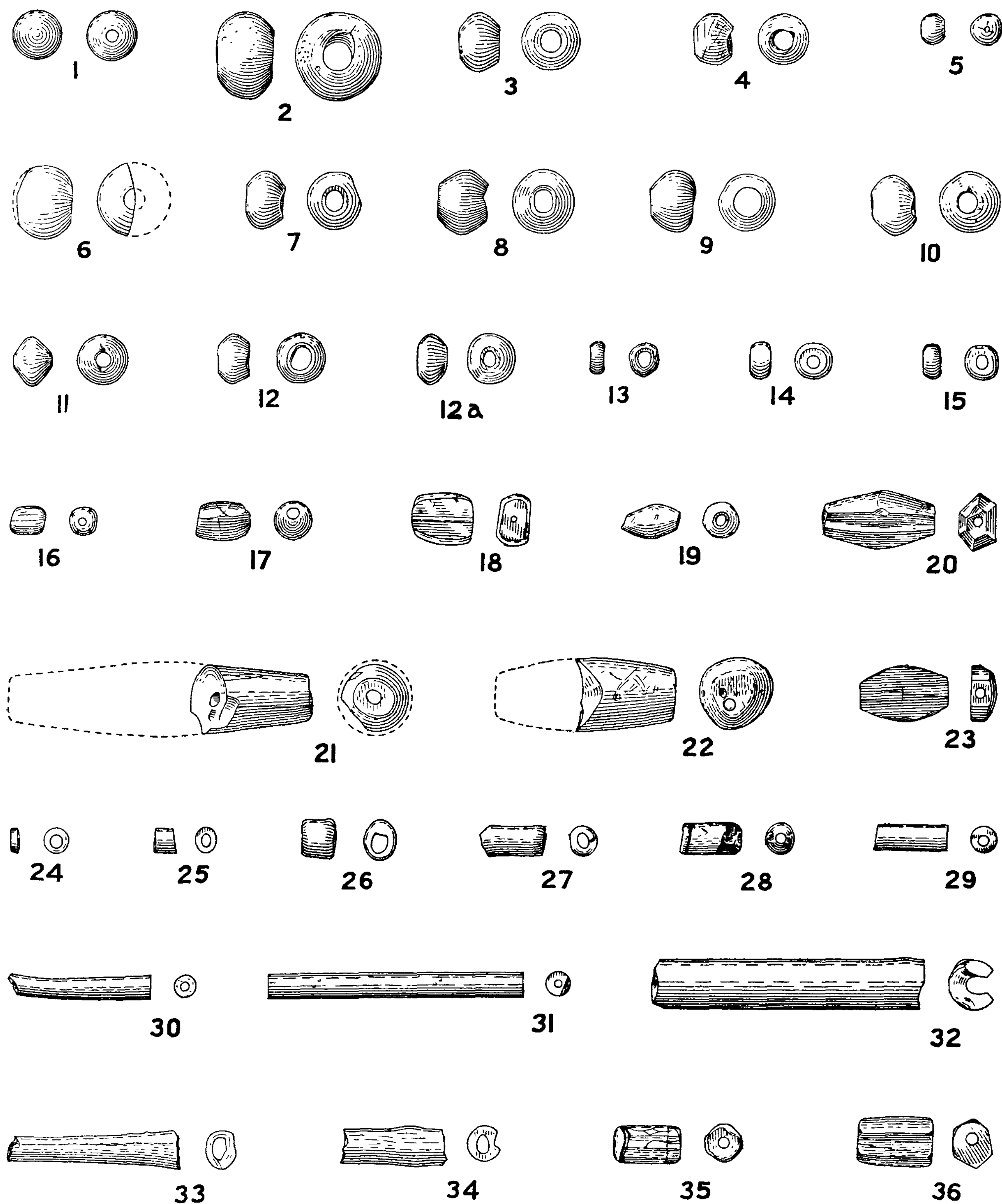


FIG. 40. *Beads.* 1/1

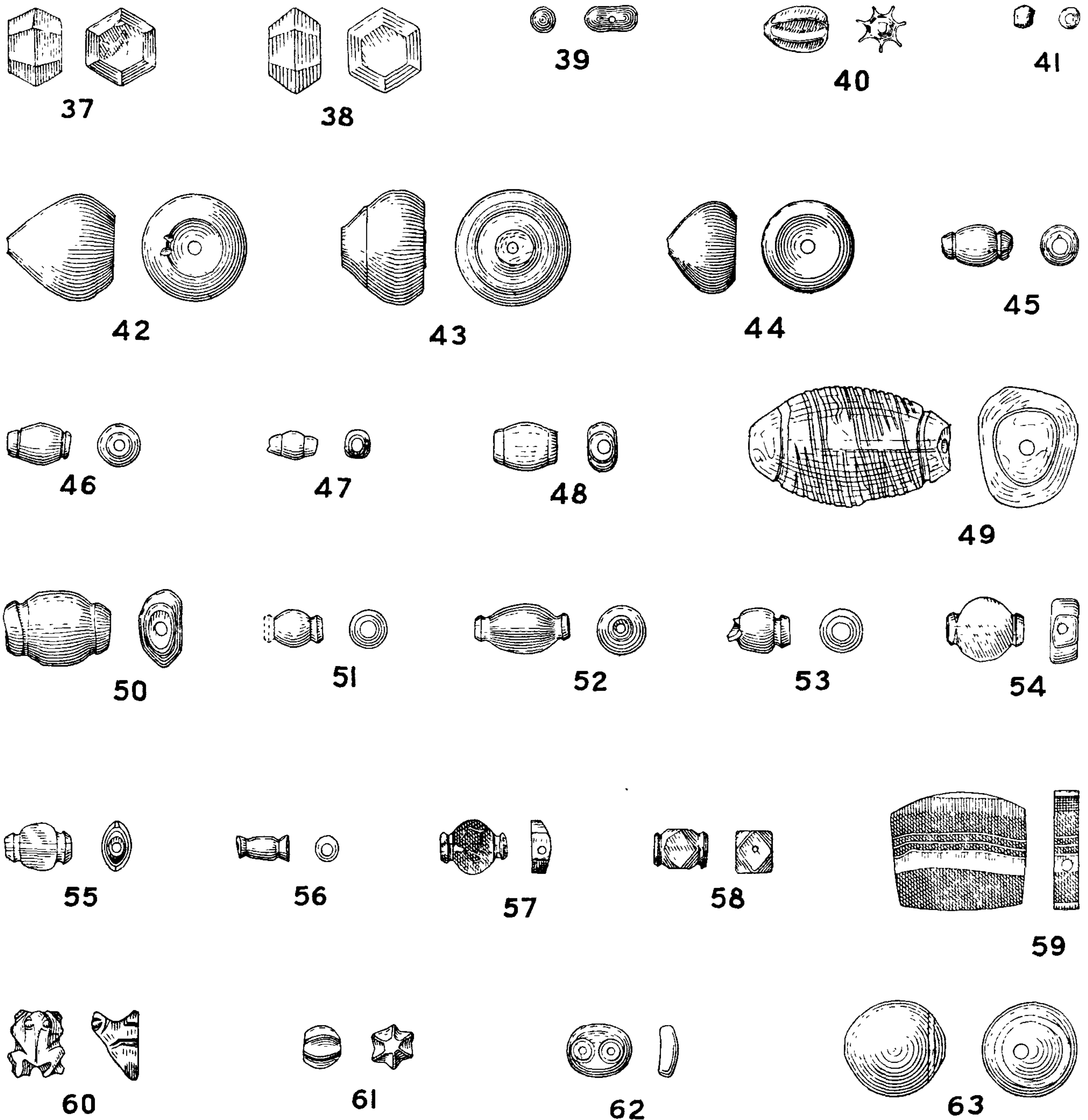
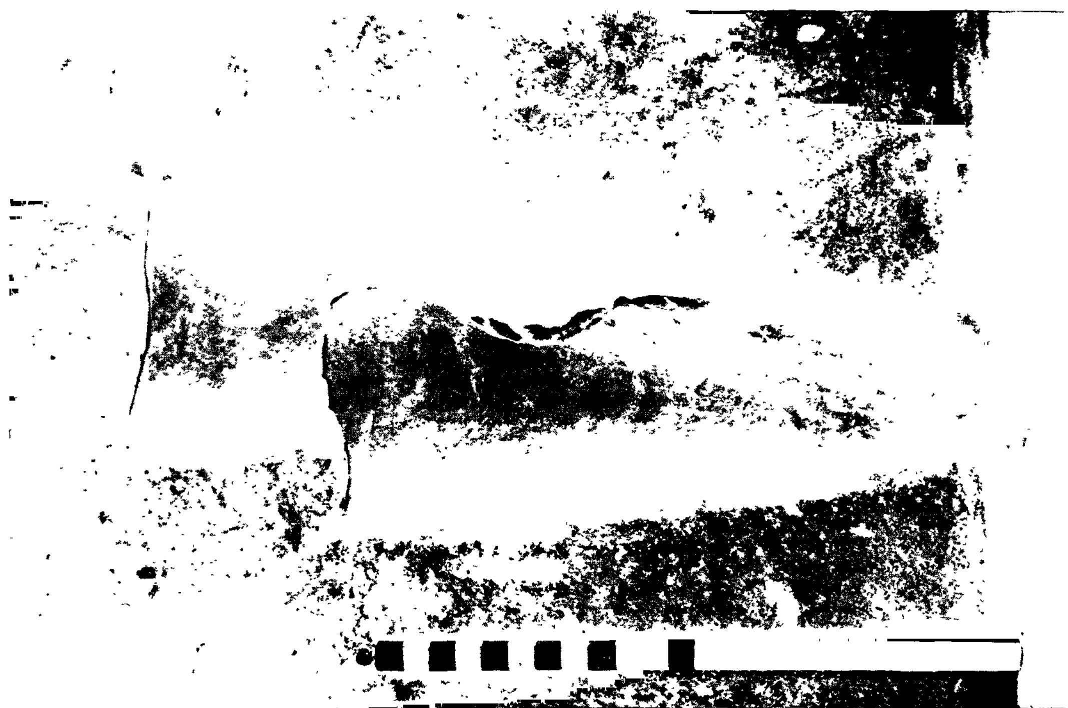
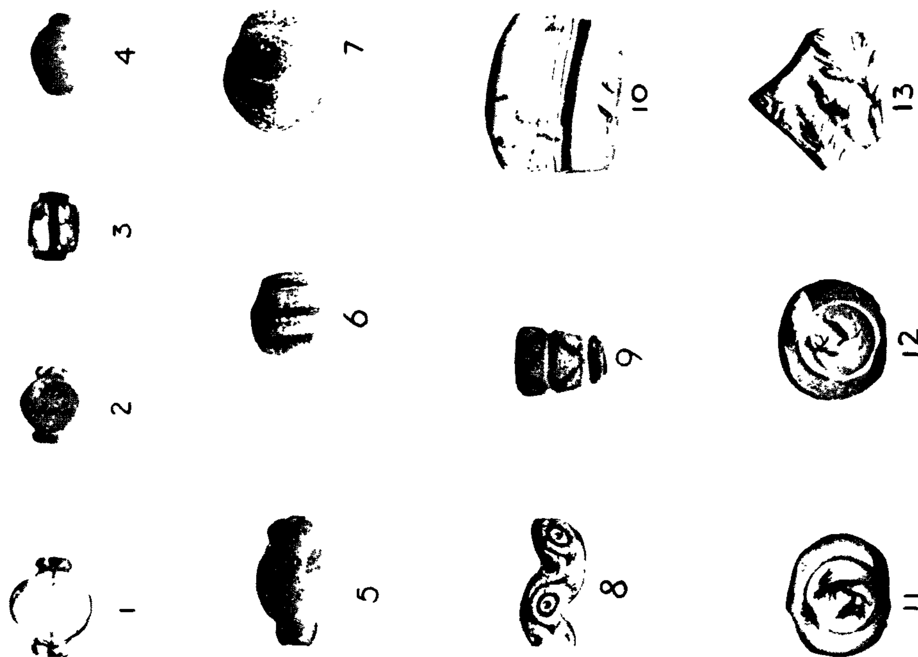


FIG. 41. *Beads.* $\frac{1}{1}$

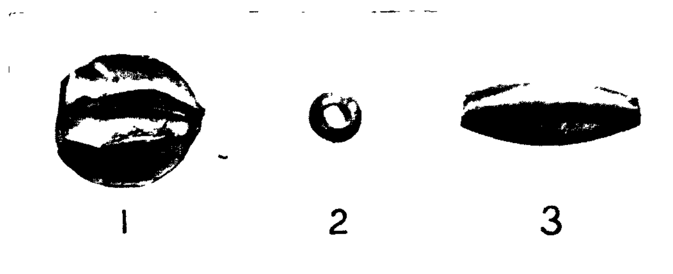
20. Carnelian: long-barrel hexagonal. Unstratified. (AK IV-113.)
21. Agate: long-barrel elliptical. Late Drain period. (AK IV-266.)
22. Agate: long-barrel roughly circular. Unstratified. (AK I-161.)
23. Amethyst: long-barrel tabular. Arretine. (AK II-545.)
24. Glass: tabular circular. Arretine. (AK II-490.)
25. Glass: cylindrical circular. Arretine. (AK VI-10.)
26. Glass: cylindrical circular. Unstratified. (AK IV-125.)



A. *Type 75, pointed bases in situ, site AK I*
(Scale of feet and inches)



B. *Objects found previously at Arikamedu:*
1-2, 4-7, glass beads; 3, amethyst bead; 10, bead of banded agate; 8-9, glass bracelets; 11-12, Graeco-Roman crystal gem, with impression; 13, sherd of decorated Arretine ware. $\frac{1}{1}$



A. *Gold beads.* Scale 2 : 1



B. *Roman glass.* $\frac{1}{1}$

27. Glass: long-cylindrical circular. Unstratified. (AK I-93.)
28. Agate: long-cylindrical circular. Post-Arretine. (AK II-487.)
29. Glass: long-cylindrical circular. Post-Arretine. (AK V-39.)
30. Glass: long-cylindrical circular. Unstratified. (AK I-108.)
31. Glass: long-cylindrical circular. Arretine. (AK II-315.)
32. Glass: long-cylindrical circular. Post-Arretine. (AK III-65.)
33. Glass: long-cylindrical circular (misshaped). Unstratified. (AK IV-25.)
34. Glass: long-cylindrical circular (misshaped). Unstratified. (AK IV-146.)
35. Agate: cylindrical circular. Post-Arretine. (AK II-221.)
36. Amethyst: cylindrical hexagonal. Arretine. (AK II-238.)
37. Amethyst: truncated bicone hexagonal. Post-Arretine. (AK II-453.)
38. Crystalline quartz: truncated bicone hexagonal. Unstratified. (AK I-27.)
39. Glass: toggle. Post-Arretine. (AK VII-20.)
40. Gold: long-barrel fluted. Arretine. (AK II-359.) (See also pl. XXXIVA, 1.)
41. Gold: circular. Post-Arretine. (AK II-596.) (See also pl. XXXIVA, 2.)
42. Terracotta: pear-shaped. Pre-Arretine. (AK V-90.)
43. Terracotta: pear-shaped. Pre-structural. (AK IV-300.)
44. Terracotta: pear-shaped. Early Phase. (AK IV-232.)
45. Glass: barrel circular groove-collared. Pre-Arretine. (AK II-558.)
46. Glass: barrel circular groove-collared. Arretine. (AK II-548.)
47. Glass: barrel circular groove-collared. Post-Arretine. (AK II-483.)
48. Glass: barrel elliptical groove-collared. Unstratified. (AK I-29.)
49. Quartz-crystal: unfinished barrel groove-collared. Unstratified. (AK IV-48.)
50. Amethyst: barrel roughly elliptical groove-collared. Pondicherry Bibliothéque.
51. Shell: barrel circular lug-collared. Arretine. (AK II-390.)
52. Amethyst: barrel circular lug-collared. Post-Arretine. (AK II-544.)
53. Glass: barrel circular lug-collared. Post-Arretine. (AK II-125.)
54. Amethyst: barrel tabular lug-collared. Post-Arretine. (AK VII-38.)
55. Crystalline quartz: barrel elliptical lug-collared. Unstratified. (AK I-5.)
56. Glass: barrel circular lug-collared. Unstratified. (AK IV-108.)
57. Glass: barrel plano-convex lug-collared. Pondicherry Bibliothéque.
58. Amethyst: cornerless cube lug-collared. Pondicherry Bibliothéque.
59. Agate: barrel (almost plano-convex) tabular. Pondicherry Bibliothéque. (See also pl. XXXIII, 10.)
60. Glass: frog-bead. Pondicherry Bibliothéque.
61. Carnelian: barrel gadrooned. Pondicherry Bibliothéque.
62. Agate: elliptical plano-convex double-eye. Pondicherry Bibliothéque.
63. Agate: spherical single eye. Pondicherry Bibliothéque.

F. Graeco-Roman gem (pl. XXXIIIB, 12)

Reference has been made to the casual discovery of a gem said to bear the head of Augustus in intaglio (above, p. 21). The Bibliothéque at Pondicherry also contains a quartz intaglio of Graeco-Roman workmanship representing Cupid and a bird, apparently an eagle. The gem is untrimmed and may therefore have been made locally by a Mediterranean craftsman. It was found on the site but there is no record of the circumstances.

G. Roman lamp (fig. 42, 1)

Fragment of the disc and side-volute of a Roman lamp, here restored in accordance with the normal form of the Augustan period (early first century A.D.). Of fine red ware. Found in the spoil-trench over the principal wall of AK II; not stratified. Another fragment of a Roman lamp was found in the previous excavations.

H. Roman glass bowls

(1) Fragment of pillar-moulded bowl of whitish iridescent glass. Northern Sector, post-Arretine. Bowls of this type originated apparently in Italy, and spread throughout the Roman world from the end of the first century B.C. to the end of the first century A.D. In Germany, they occur at Haltern (11 B.C.–A.D. 16) and are very common at Hofheim (A.D. 40–51), but are almost completely absent from the forts of the German Limes, dating from the end of the first century A.D. onwards.[1] Fig. 42, 2; also pl. XXXIVB, 1. Fragments of four or five similar bowls were found at Arikamedu by the French excavators.

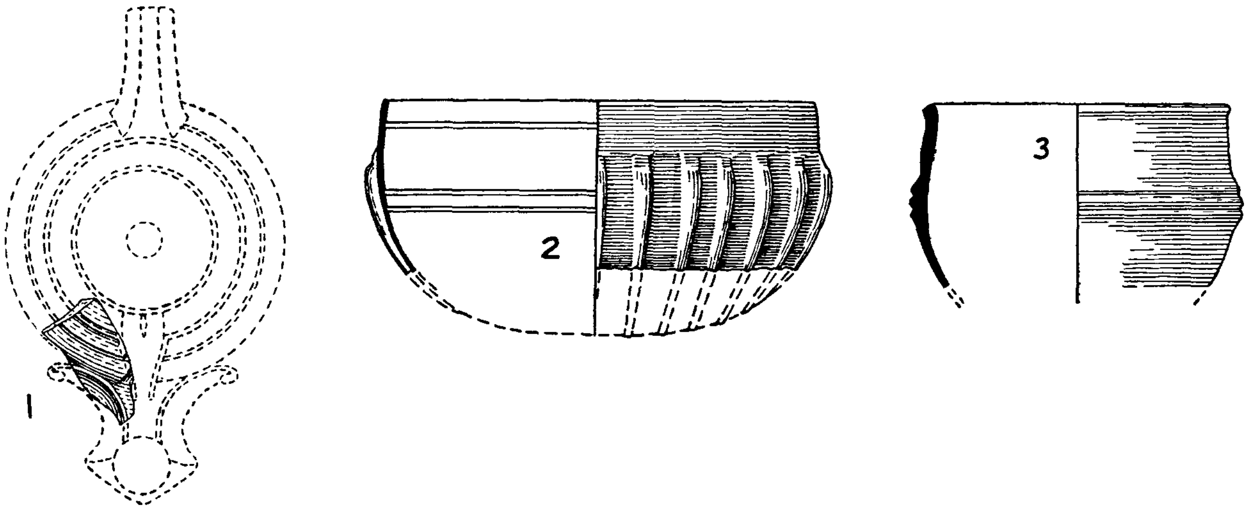


Fig. 42. *1, Roman pottery lamp; 2-3, Roman glass bowls.* ½

(2) Fragment of bowl of blue glass with horizontally ribbed side. Northern Sector, pre-Arretine. Doubtless also of Mediterranean origin. Fig. 42, 3; also pl. XXXIVB, 2.

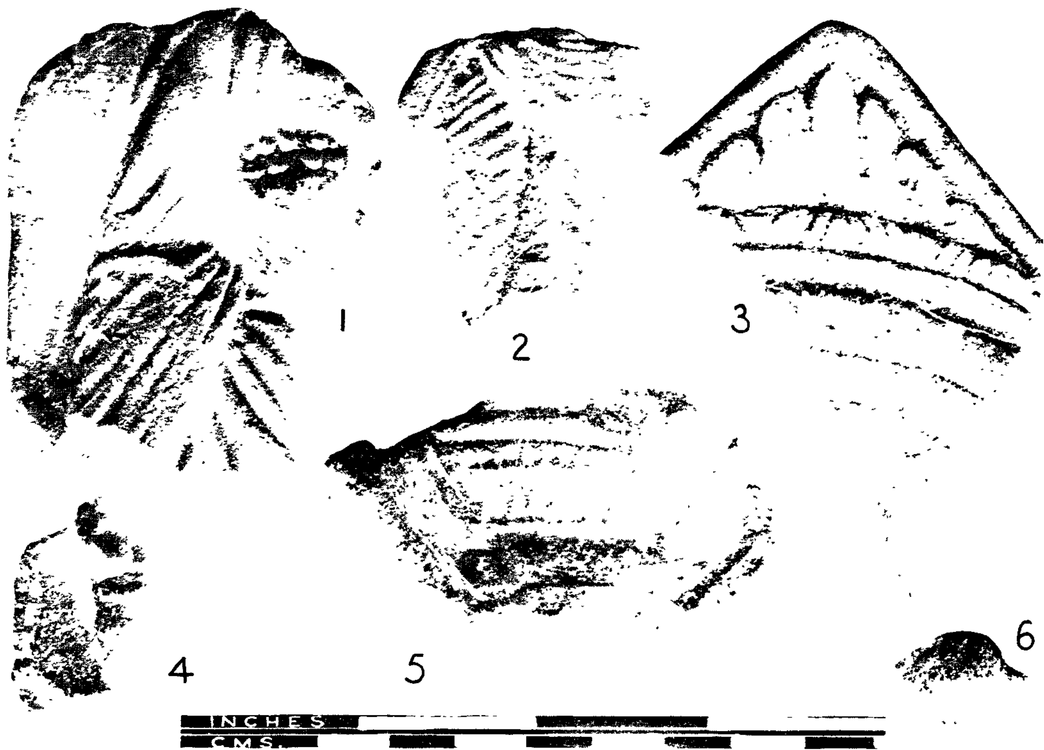
I. Terracotta objects

Compared with the prolific sites of northern India, the terracotta objects found at Arikamedu are surprisingly few in number. Nor can these few be put in their proper places among analogous finds from South Indian sites, as very little terracotta material from South India is at present available for study. The following objects, together with the beads mentioned above (p. 96), comprise the whole of the terracotta from the present excavation:—

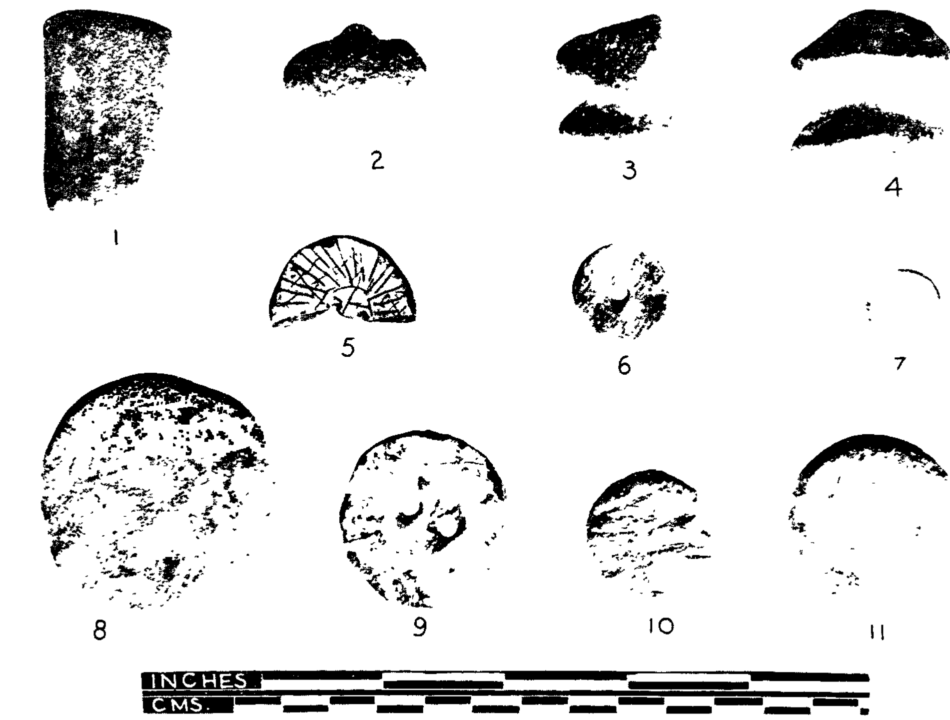
(1) Torso of a female figure in the round. The right arm hangs down and touches the hip, while the left is placed akimbo, holding a basket of seeds or fruits. The figure is heavily draped, the right end of the *sārī* being tucked up and wound round the waist (pl. XXXVA, 1). Northern Sector, pre-Arretine (end of first century B.C. or beginning of first century A.D.).

(2) Torso of a female figure in the round. The left hand hangs down and touches the hip, while the right is probably held akimbo. The figure is also heavily, but somewhat differently, draped. The upper garment, starting obviously from the right shoulder, passes below the left arm; the folds of the lower one are depicted by oblique parallel lines. A long raised tassel hangs throughout the centre of the lower portion of the body (pl. XXXVA, 2). Northern Sector, Arretine period (first half of first century A.D.).

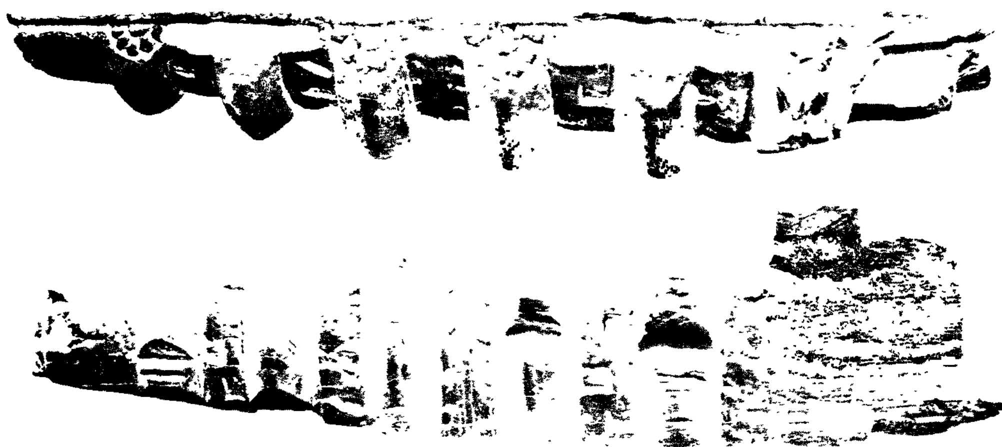
[1] See E. Ritterling, *Das Frühromische Lager bei Hofheim*, pp. 371-2.



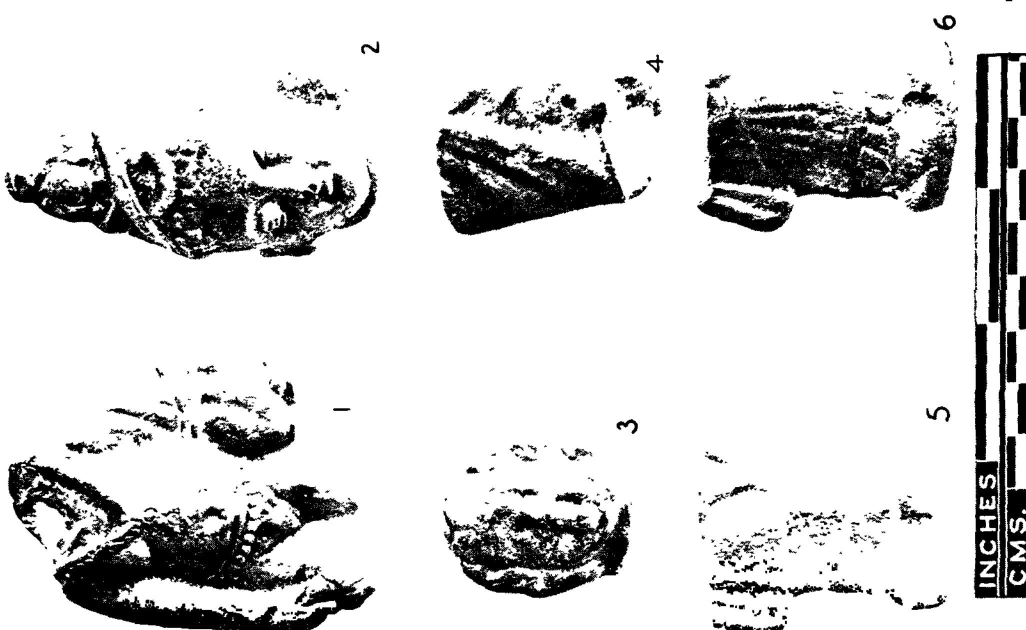
A. *Terracottas found in 1945*



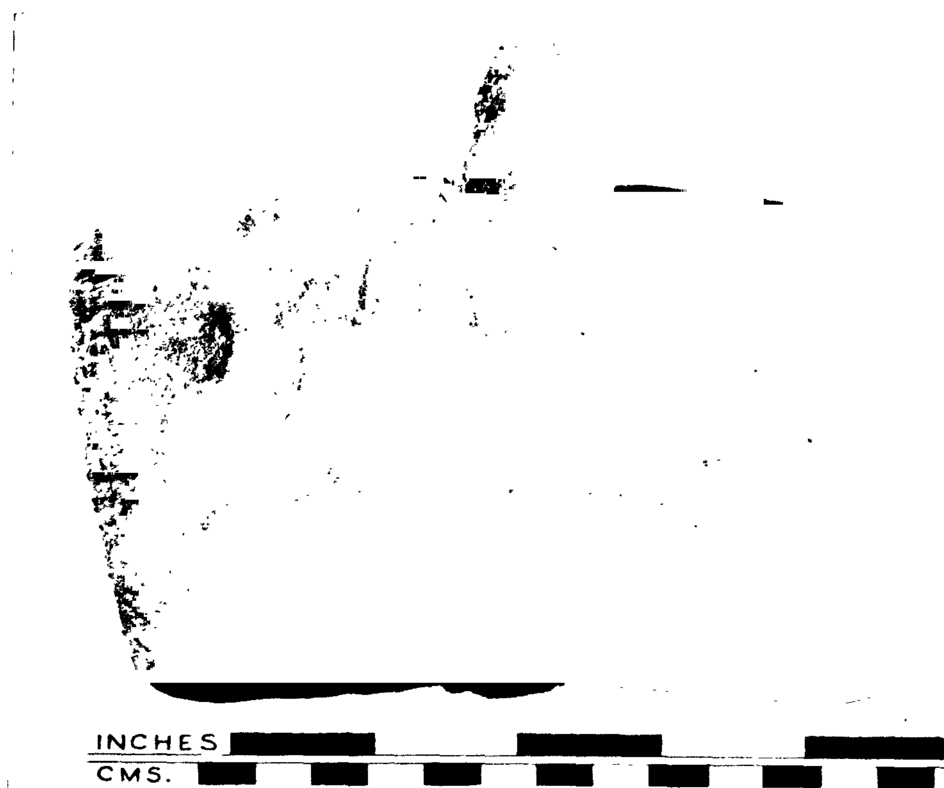
B. *Gaming pieces, etc.*



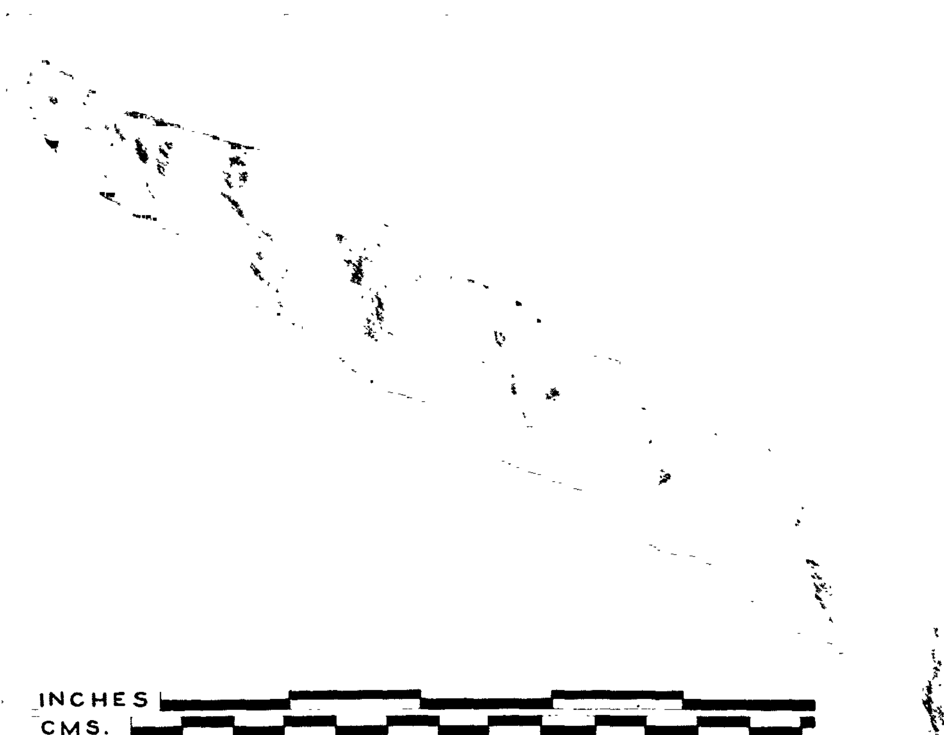
B. *Carved ivory found before 1945.* $\frac{1}{1}$



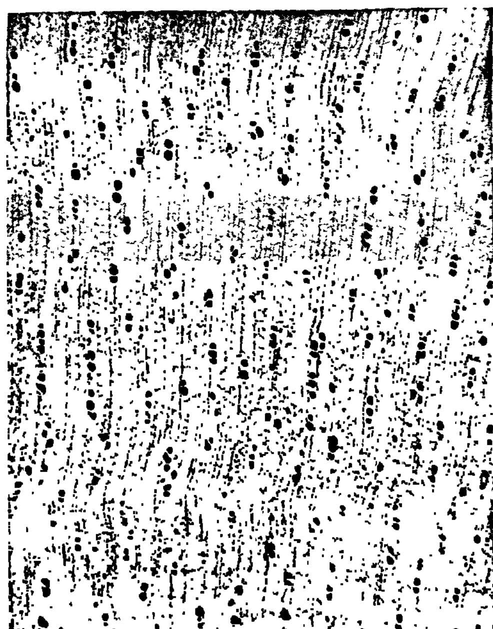
A. *Terracottas found at Arikamedu before 1945*



A. *Wooden mallet, pre-Arretine*



B. *Rope, pre-Arretine*



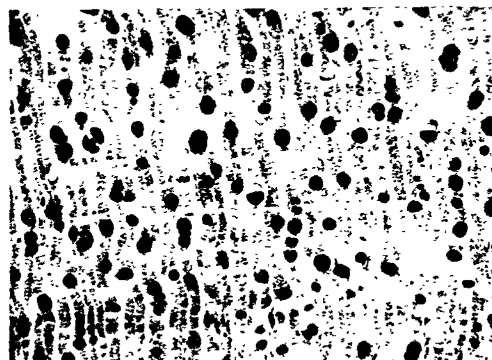
1



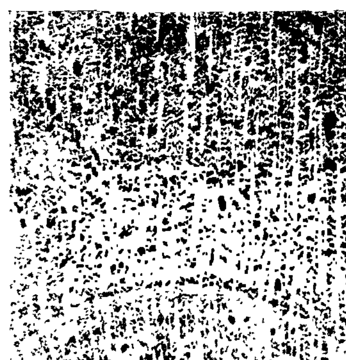
2



3



4



5

Sections of wood from pre-Arretine layers. 1-2, cross-sections of AK II, 552; 3, tangential section of AK II, 552; 4, cross-section of AK II, 554, well-preserved portion; 5, cross-section of AK II, 554, badly twisted portion. All magnified 10 times, except No. 3 which is magnified 50 times.

(3) Left upraised hand of a human figure with a bangle, the fingers clutching what seems to be the stalk of a flower (pl. XXXVA, 4). Northern Sector, post-Arretine (second half of first century A.D.).

(4) Fragment of a square or rectangular slab of the *āyāgapaṭa* type. The portion round the centre seems to have been undecorated. Beyond are concentric circles, followed in the extant corner by a conventional honeysuckle design. The edges are decorated by oblique hatching (pl. XXXVA, 3). Southern Sector, Late Phase.

(5) Irregularly shaped fragmentary object, possibly of the 'votive tank' type. The field is decorated with short notches (pl. XXXVA, 5). Southern Sector, unstratified.

(6) Object similar to the above, but more fragmentary. Southern Sector, unstratified.

(7) Crude shapeless model of an animal; a lump on the back may indicate that it was intended to represent a humped bull (pl. XXXVB, 2). Southern Sector, unstratified.

(8) and (9) Two gaming pieces, one depicting a human head with a projecting snout (pl. XXXVB, 3 and 4). Southern Sector, unstratified.

(10) Cylinder, probably also a gaming piece (pl. XXXVB, 1). Southern Sector, unstratified.

(11) Pear-shaped object with projecting knob or foot, probably a top (pl. XXXVA, 6). Southern Sector, unstratified.

A large number of terracotta discs were found from all deposits in both the Sectors except the pre-Arretine (an exception which may be accidental). Some of these pieces are only potsherds made into a roughly circular shape by rubbing, but there are a few which are deliberately moulded to shape. Some of the former class have one or two perforations at the centre, and one is decorated with rough scratches. All these may be regarded as gaming pieces. Pl. XXXVB, 5–11.

The following terracottas found during previous excavations and now in the Bibliothéque at Pondicherry may be added. They are not independently dated.

(1) Torso of a male figure, nude or more probably with diaphanous drapery. The pendant right hand holds a hook-like object, and the left a large indistinct object against the hip. The figure wears a thick necklace of cabled design, ending in two large rosette-shaped pendants and a girdle of pellets (pl. XXXVIA, 1).

(2) Head of a male figure, evidently Śiva. The high conical mass of matted hair is entwined by a serpent, and its forepart bears a crescent. The eyes are half-closed (pl. XXXVIA, 2).

(3) Head of a male figure, much defaced. The hair is curled and hangs below the ears (pl. XXXVIA, 3).

(4) Fragment of a female figure. The drapery is somewhat similar to that of No. 1 of the 1945 series (pl. XXXVIA, 4).

(5) and (6) Lower portion of two female figures standing on round pedestals. They are clad in loose skirts, which cover part of the feet, only the toes being visible (pl. XXXVIA, 5 and 6).

J. Metal objects

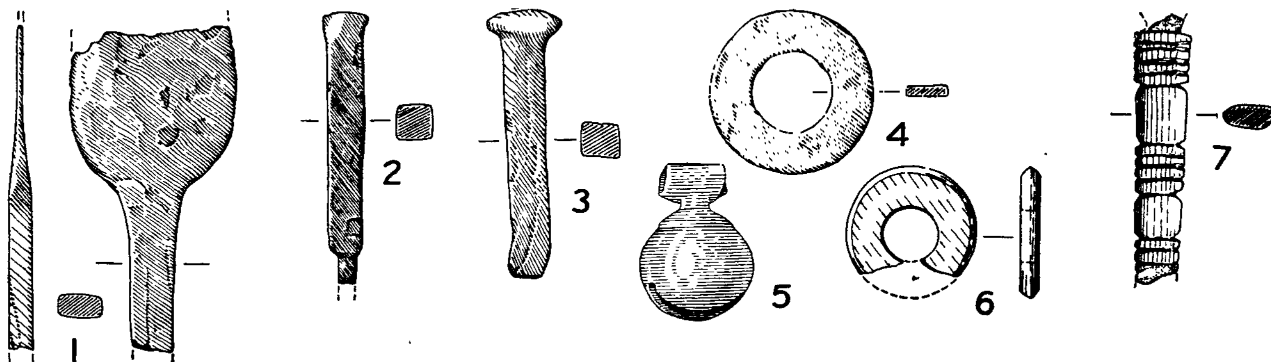


FIG. 43.—*1–4, iron objects; 5, copper rattle; 6, quartz ring; 7, ivory handle.* ½

Besides a number of shapeless lumps of iron found almost everywhere, the following objects may be recorded:—

(1) Iron ring (fig. 43, 4). Northern Sector, post-Arretine.
(2) Fragmentary iron blade, tanged (fig. 43, 1). Southern Sector, unstratified.
(3) and (4) Two iron nails, one of them with a round head (fig. 43, 2-3). Southern Sector, Early Phase, and unstratified respectively.
(5) Copper rattle with a slit and a loop for suspension (fig. 43, 5). Southern Sector, Late Drain Period (second century A.D.).

K. STONE OBJECTS

The following stone objects deserve mention:—

(1) Short cylindrical object of sandstone, possibly a weight. Northern Sector, pre-Arretine.
(2) Fragmentary grinding-stone of sandstone. Northern Sector, post-Arretine.
(3)-(6) Four fragmentary cylindrical pestles, two of granite and two of sandstone. Southern Sector, unstratified.
(7) Complete celt of trap (fig. 44, 4). Southern Sector, pre-structural.
(8) Fragmentary celt of sandstone. Southern Sector, near the surface.
(9) Knob of the steatite lid of a casket. Southern Sector, unstratified.

L. WOODEN OBJECTS AND ROPES

The water-logged sand and slime below sea-level in the Northern Sector preserved a number of pieces of wood, mostly unfashioned but in some cases shaped, together with a cocoanut shell and a few pieces of palm shell and rope, all in the pre-Arretine layers (late first century B.C. or early first century A.D.).

Of the wooden objects the following deserve mention:—

(1) Roughly fashioned block of wood, with its central portion scooped out, resembling a cumbrous shuttle, possibly a toy-boat (fig. 44, 1).
(2) Leg of a cot or stool, roughly carved, with two rectangular mortices cut into its upper portion to receive the wooden bars forming the frame (fig. 44, 3).
(3) Cylindrical piece of wood, carved into zones with shallow incised lines, possibly a toggle.
(4) Mallet, handle broken (fig. 44, 2; also pl. XXXVIIA).

Of the numerous pieces of rope the longest had a length of about nine inches and a diameter of about one inch. Like all the other pieces it was made of three strands of cocoanut fibres twisted together (pl. XXXVIIB).

REPORT ON WOOD AND FRUIT SHELLS

By

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1. *Material*

Six specimens of wood and two pieces of fruit shells, collected from Arikamedu (near Pondicherry) from about 4 feet below the sea-level, were received for identification and report. On first examination the wood specimens were found to be in a late stage of deterioration. All attempts to cut clean surfaces with a sharp pocket-knife met with failure. The tissues got crushed by the action of the knife and came out in a powdery form. This so obliterated the anatomical structure that it was not possible to hazard even a guess as to the identity of these specimens.

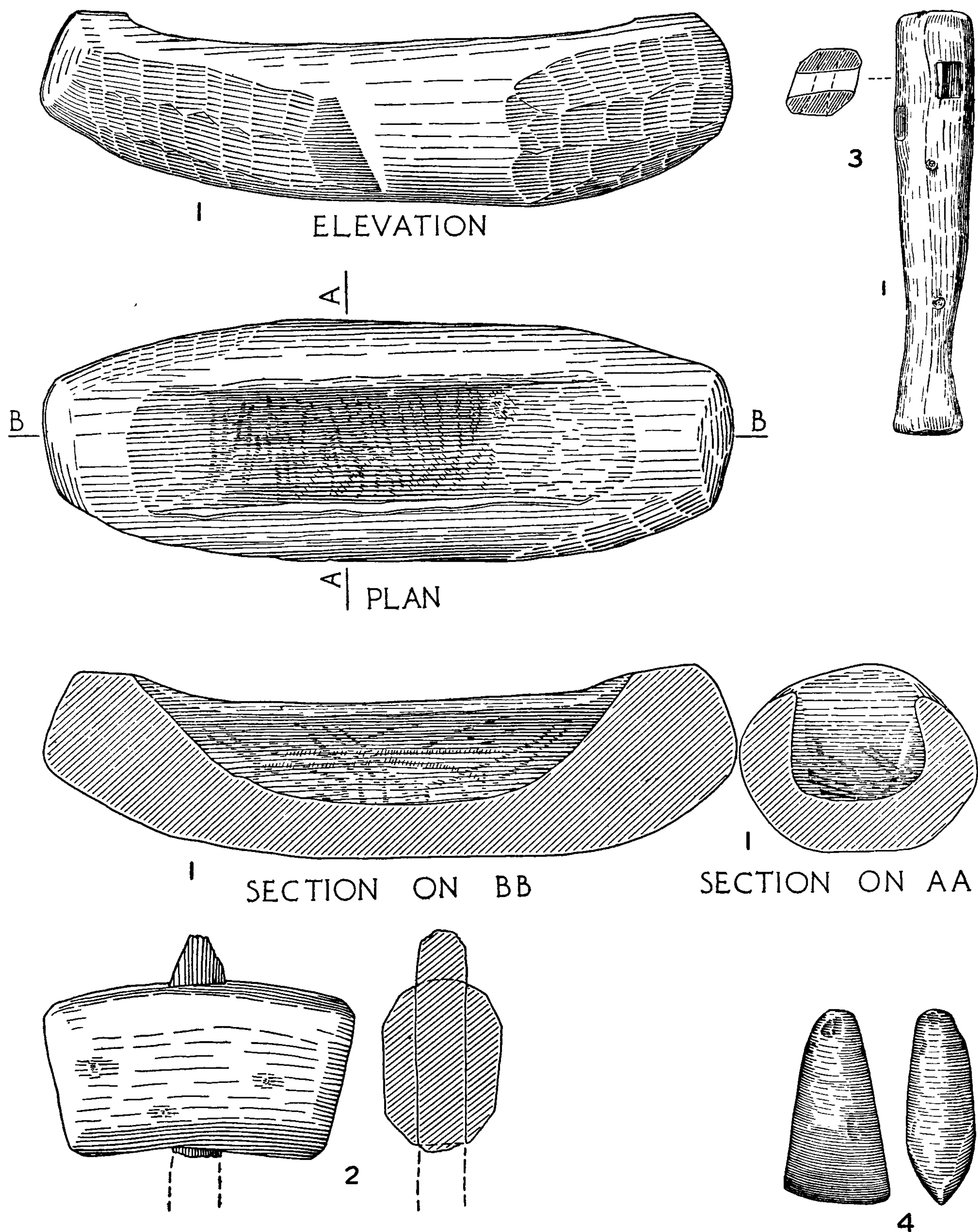


FIG. 44. *1–3, objects of wood; 4, stone axe.* ⅓

2. *Method of study*

The wood samples were embedded in celloidin. Small pieces, ½ inch to ¾ inch square, were cut with a sharp hacksaw and put in 70% alcohol overnight. Air was drawn out with the help of a vacuum-pump and the specimens were passed through 90% and absolute alcohol giving two changes in each daily. They were then put into alcohol-ether solution twice for twelve hours. The samples were then put through the celloidin solution of 2% to 4% to 6% to 8% to 12% to 16%. A pressure cylinder was used to expedite the process of embedding.[1] Each stage lasted for 24 hours under pressure of 80 lb. per inch. At the last stage the samples with a thick coating of celloidin on them were put into chloroform for four hours for hardening. The material was next transferred to tubes containing 30% of alcohol. A few drops of chloroform were added later, as it was noticed that the blocks were turning gradually spongy. Sections were then cut with a Jeffrey-Thomson Microtome, 15 to 30 μ thick. Difficulty was still experienced in cutting these specimens as they were breaking into pieces. To get over this, a thin coating of 2% celloidin solution was applied to keep the tissues intact while cutting. The sections were then cut from all the three surfaces, and put into 50% alcohol. They were then stained in Haidenhain's haematoxylin and Bismark brown. Due to the delicate nature of the sections, it was necessary to handle them carefully for staining and dehydrating. Before permanently mounting them in Canada Balsam, they were passed hurriedly through a mixture of absolute alcohol and ether to remove the celloidin. Sometimes this step had to be omitted because, on dissolving, the celloidin sections broke into pieces. To overcome this, sections were passed through 90% alcohol and absolute alcohol, adding a little chloroform in each. Even then, some sections were not found satisfactory for detailed study under microscope. In the case of AK II-535 and AK II-554, the cells were pressed so much that it was not possible to make out the diagnostic features of these timbers. Fresh sets of blocks were, therefore, prepared and put into hot KOH (5%) solution for about two hours. They were then washed thoroughly in hot water, passed through the alcohol series and finally embedded in celloidin. By this method sections showing better details were obtained except one sample of AK II-554, which still appeared to be greatly twisted (pl. XXXVIII, 5). It was not possible to obtain good transverse sections of this piece, but tangential and radial sections were fairly good and showed all the minute details required for definite identification.

3. *Results*

The microscopic slides prepared were first examined under lower-power microscope. It was noticed that the six samples of wood actually came from three different trees. Two pieces marked by the Archaeological Department as AK II-552 and the piece marked AK II-535 came from one tree, one piece marked AK II-552 from a second tree and the two pieces marked AK II-554 from a third tree. Detailed anatomical report on their examination is given below.

Specimen Nos. AK II-552 (two pieces) and AK II-535

Gross feature of the wood: The biggest of these three specimens was 4 inches × 3 inches and the smallest about 2 inches × ½ inch. Specimen Nos. AK II-552 were from a branch, for both the pith and the bark were noticed in them. The colours of all the specimens were dirty brown to blackish brown, and some parts appeared to be charred. It is a *diffuse-porous* wood with faint growth marks. *Vessels* very small, just visible with a lens, scanty, often arranged in radial chains. *Soft tissues* in fine tangential lines, often forming net-like structure with the rays. *Rays* are extremely fine and equidistant.

Microscopic structure of the wood : growth-rings are delimited by thick and flattened fibres. *Vessels* are single or in radial pairs. These have been tangentially pressed often beyond recognition and look like radial grooves. Only in well-preserved portions the true size and distribution of the vessels could be seen. Pits on the vessel walls are noticed with difficulty, as the majority of the vessels are crushed. When distinct, the pits are minute, round to oval and crowded. Tylosis has not been noticed. *Parenchyma cells* are usually well preserved. They are prominent against the background of the wood and are abundant. Their distribution varies from diffuse to reticulum with the rays, to almost concentric lines (pl. **XXXVIII**, 2). These are mostly one cell wide; crystals in some cells conspicuous in vertical sections. *Pith flecks* present in one place. *Rays* mostly 1-seriate (rarely 2-seriate), heterogeneous; upright cells are long and form the major part of the uniseriate rays;

[1] K. A. Chowdhury, 'An improved method of softening hard wood-tissues in hydrofluoric acid under pressure,' *Ann. Bot.*, XLVIII, 1934.

horizontal cells small and difficult to be distinguished. *Fibres* individually unrecognizable, small, rather thick-walled and packed in groups in between the parenchyma bands and rays. They are non-septate. From the nature of the structure, it appears to be a fine-textured, hard and tough timber.

Identification: From the above it will be noticed that these ancient timbers in cross-section resemble *Excaecaria agallocha*, *Mallotus* spp., *Trewia nudiflora*, *Sapium* spp., *Diospyros* and *Maba* spp. But of these, only *Diospyros* and *Maba* spp. show the greatest affinity in all respects, e.g. fibres, parenchyma cells, vessels and rays. Moreover, the pits are also similar. The ancient timber specimens are, therefore, identified as *Diospyros* and *Maba* spp.

Specimen No. AK II-552 (one piece)

Gross feature of the wood: The specimen is about 3 inches × 2 inches in size and rather irregular in shape. Its colour is dark brown. *It is a diffuse-porous wood. Growth rings* indistinct. *Pores* hardly visible to the eye but distinct with a lens, small, in radial pairs of 2–5 (mostly 2-3). *Soft tissues* hardly to just visible with a lens, scattered in the fibrous tissues. *Rays* visible with a lens, fine and equidistant.

Microscopic structure of the wood: growth rings indistinct; there is, however, a suggestion of growth marks at places due to flattened fibres and scanty pores. *Vessels* small, mostly in radial pairs of 2-3, thick-walled; vessel perforation plate simple; pits on the walls small, numerous, round to oval and crowded; tyloses absent. Tracheids present close to the vessels, heavily pitted. *Parenchyma cells* distinct, well-preserved, wider than fibres, generally scattered, also form irregular reticulum with the rays (pl. XXXVIII, 1). *Fibres* non-septate, narrow but thick-walled, lumen almost closed, closely packed. Fibres are not always well preserved and often the thickening of the cell wall difficult to determine; inter-fibre pits scanty or not seen. *Rays* well preserved, closely spaced, 1–4 seriate (mostly 2) and heterogeneous; (*a*) uniseriate type consists entirely of upright or high cells, and (*b*) multiseriate type consists of both upright and horizontal cells, sometimes alternately arranged forming very deep rays (pl. XXXVIII, 3).

Identification: The arrangement of vessels indicates affinity to *Sapotaceae*, *Ebenaceae*, *Apocynaceae* and *Rubiaceae*. But in the dense nature of the wood, small and very thick-walled fibres and the heterogeneous rays, it resembles most closely *Sapotaceae*. All the timbers of this family have been compared and the structure of the ancient wood shows greatest affinity to *Mimusops*. It has, therefore, been identified as *Mimusops* spp.

Specimen No. AK II-554 (two pieces)

Gross feature of the wood: The specimens are fairly large (4 inches × 2 inches) and appear to be portions of a large tree. The colour of the wood is dark red. *Growth rings* indistinct. *It is a diffuse-porous wood. Pores* fairly large, visible to the eye, single or in radial pairs, uniformly distributed. *Soft tissues* indistinct to the eye. *Rays* only visible with a lens, fairly broad.

Microscopic structure of the wood: growth rings inconspicuous. *Vessels* medium-sized, round to oval, uniformly distributed; perforation plate simple; pits distinct, roundish and crowded. *Parenchyma cells* conspicuous by their uniform distribution and heavy deposits, often forming net-like structure with the rays; tangential band of parenchyma (2-3 cells) noticed in one place (pl. XXXVIII, 4). *Fibres* narrow, thick-walled, small lumened. In some portions fibre walls have been dissolved away, and cells have collapsed. *Rays* fine to broad, 1–8 cells wide, sometimes twisted, showing up prominently due to profuse reddish-brown deposits. Rays two types—the short type is of equal height and forms irregular ripple-marks, the other very deep and broad. *Ripple-marks* inconspicuous. *Gum canals* found in two places. In one place large canals are of irregular shape and occur in three adjacent rows. In another specimen they are small in size embedded in the tangential band of parenchyma.

Identification: This timber apparently belongs to the group *Malvales*, i.e. *Sterculiaceae*, *Tiliaceae* and *Malvaceae*. On comparison it shows most affinity with *Heritiera* having dense structure, parenchyma network with heavy deposits. Rays are of two types—high and low: the former forming the ripple-marks and the latter very deep and wide. The timber is, therefore, identified as *Heritiera* spp.

4. *Fruit shells*

The pieces of fruit shells sent have been examined and identified as probably portions of cocoanut (*Cocos nucifera*) and palmyra (*Borassus flabellifer*).

5. *General remarks*

The wood specimens examined show that they represent portions of wood from three different trees, viz. *Diospyros* spp. (including *Maba* spp.), *Mimusops* spp. and *Heritiera* spp. All these trees at present produce well-known commercial timbers. *Diospyros* and *Maba*, the former containing some very important and large forest trees, occur chiefly in South India, Ceylon, Bengal, Burma and the Andaman Islands; only a few species extend to northern India. From a commercial point of view the wood is important and is commonly used for turnery and carving walking sticks, umbrella handles, inlay for furniture and fancy articles. Moreover, the well-known black ebony comes from one of the timbers belonging to this group. *Mimusops* are evergreen trees and are found on the east coast from the Kistna river southwards, in the Carnatic, in ravines and hills; on the west coast from Bombay to Travancore and also in Burma and the Andaman Islands. The timber is strong and durable and is commonly used for oil presses, tool handles, piles, ploughs, harrows, carts, boats, rice pounders and also for building and constructional purposes. *Heritieras* are usually associated with tidal and delta forests of India and are well represented in the Sunderbans, Chittagong tidal forests, coast forests of Burma and the Andamans. In South India the distribution is rather local: they are found on the west coast of Cochin, Tinnevelly, Travancore and perhaps also in the east coast in southern districts. The timber samples of *Heritiera* which we have examined appear to come from a fairly large tree. From this one is inclined to think that the wood may not have been locally obtained. This timber is extensively used for boat-building, agricultural implements, carts, constructional purposes, and fuel.

Our thanks are due to Messrs. K. N. Tandon and Damar Singh of the Wood Technology Section, Forest Research Institute, for their help.

M. Miscellanea

The post-Arretine layers in the Northern Sector yielded a very large number of sawn conch-shells, possibly unfinished bangles, although no finished bangle was found. A few pieces are crescent-shaped and may have been used as ear-ornaments (pl. XXXIX).

A fragment of a bangle of amber-coloured glass, with lozenge-shaped impressions, alternately filled with dots and an oblique line, constitutes the only glass bangle found in 1945. It is from a superficial and unstratified deposit in the Southern Sector, and may post-date the urban occupation. In the Pondicherry Bibliothéque are fragments of two other glass bangles from the previous excavations (pl. XXXIIIB, 8-9).

The following objects are of uncertain use:—

(1) A flat ring of crystalline quartz (fig. 43, 6). Northern Sector, post-Arretine.

(2) A long piece of ivory, elliptical in section, divided into zones with parallel incised lines (fig. 43, 7). Northern Sector, pre-Arretine.

(3) Fragment of an ivory handle (?) of plano-convex section, divided into zones by raised bands, the sides containing at least two mortices, the intervening space decorated by rosettes (pl. XXXVIB). Found in the previous excavations, now in the Pondicherry Bibliothéque.

N. Coins

Two coins were found in late post-structural deposits in the Southern Sector (AK IV). One of them is corroded and without any details; the other one belongs to a well-known type of Rājarāja Coḷa (A.D. 985–1017).[1] A third coin, utterly defaced, was unstratified.

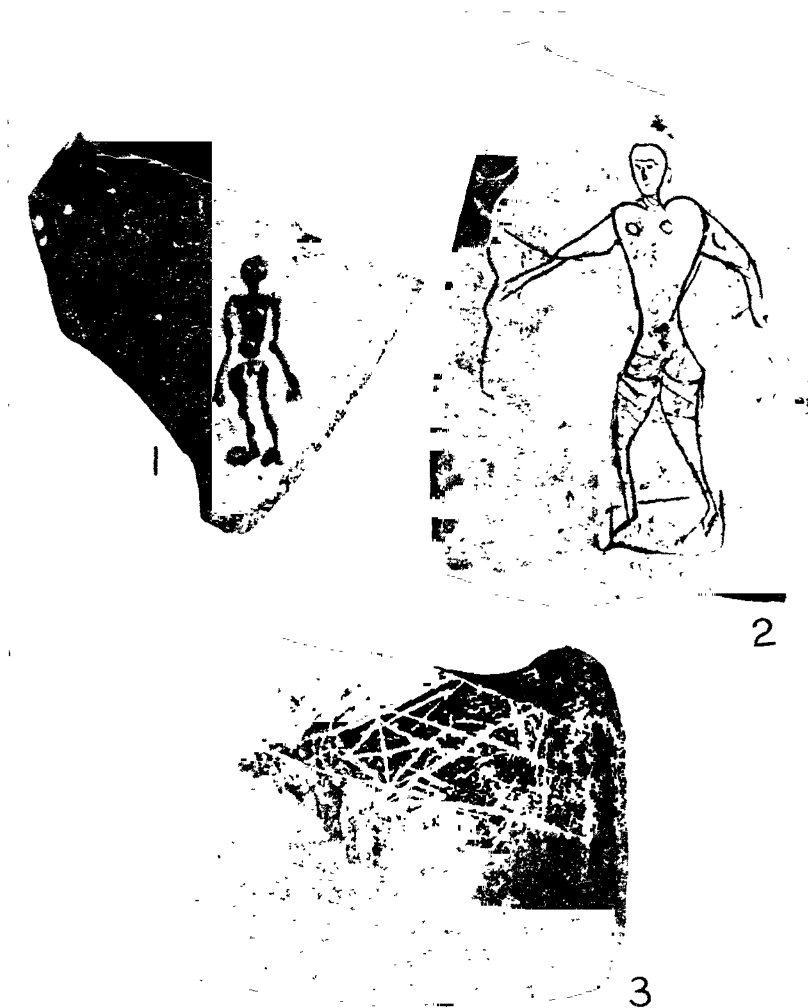
O. Pictorial graffiti on potsherds (pl. XL)

The graffiti showing *svastika* pattern have already been noticed above (pp. 49, 52). Arikamedu has also yielded the following pictorial graffiti, all on sherds of pottery Type 1:—

[1] Cf. W. Elliot, *Coins of Southern India*, London, 1886, p. 133 and pl. iv, 166. The Superintendent, Government Museum, Madras, informs me that coins of this type are exceedingly common in the southern districts of the Madras Presidency.



Unfinished shell bangles



Pictorial graffiti on potsherds. $\frac{1}{1}$

1. Standing human figure carved in intaglio. From the post-Arretine phase of the Northern Sector (middle or second half of first century A.D.).

2. Male figure standing facing with arms extended. The figure is draped in a loose garment (*dhoti*) and is apparently holding a bow. From an unstratified deposit of the Northern Sector.

3. Geometrical representation of a fish. From Pottery Group A (Early Phase) of the Southern Sector (mid first century A.D.).

P. INSCRIBED POTSHERDS [1]

The present excavations yielded eighteen potsherds bearing graffiti. The opportunity is taken to publish also two graffiti found previously by the French excavators.

1. *Date*

Their associations indicate clearly that these graffiti belong to the first and second centuries A.D.

2. *Language*

All save two of the graffiti which are capable of reconstruction are in Tamil, and are amongst the earliest known examples of that language. Unfortunately their limitation to names and a few Tamil words robs them of value as a contribution to the study of linguistic development. So far as can be determined, their language is akin to that of some fifty short epigraphs found engraved on rocks at natural rock-shelters in South India, especially in the Districts of Madurā and Tinnevelly.[2] The exact nature of the language of these inscriptions is still open to question, but they appear to be in Early Tamil (as distinguished from the Tamil found in the early Tamil literature, as well as modern Tamil), with a sprinkling of Prākrit. They have been dated to the third and second centuries B.C. but on grounds which are largely theoretical, in contradistinction to the dating of the Arikamedu sherds which is objective and secure.

Dr. N. P. Chakravarti adds the following comment:—

'At first sight the script found on the graffiti from Arikamedu appears to belong to the first or second century B.C. when compared with the script of other Brāhmī inscriptions, particularly those found in the north. On the other hand, the date of the pottery as indicated by its association with dated antiquities, is of the first century A.D. or near date. The reason for this discrepancy is not, however, far to seek. The script of the Arikamedu pottery and the early rock-shelters of the Madurā and Tinnevelly Districts seems to be more akin to the ancient Drāviḍī script than the regular Brāhmī as found in the edicts of Aśoka and other early inscriptions. We also know that the Drāviḍī script must have separated from the main stock of Brāhmī much earlier than the time of Aśoka, at the latest in the fifth century B.C. (Bühler, "Indian Palaeography", *Indian Antiquary*, XXXIII, appendix, p. 8) This is undoubtedly the reason why so many archaic forms are noticed in the few inscriptions so far known in the Drāviḍī script. The development of forms after separation could not be so fast in Drāviḍī as in the regular Brāhmī, which continued to be used throughout the whole of India. If we bear this point in mind it would not be unreasonable to assume that, though the script of the Arikamedu graffiti appears to be similar to the script of Brāhmī inscriptions of the first and second centuries B.C., it

[1] This section is based upon reports from Dr. B. C. Chhabra, the Government Epigraphist, Dr. N. P. Chakravarti, his predecessor in the office, Mr. K. V. Subrahmanya Aiyer, and Mr. N. Lakshminarayan Rao.

[2] H. Krishna Sastri in *Proceedings and Transactions of the All-India Oriental Conference*, 1920, pp. 327–48; K. V. Subrahmanya Aiyer, *ibid.*, 1924, pp. 275–300.

PALAEOGRAPHICAL CHART OF SELECT LETTERS FROM EARLY SOUTH INDIAN INSCRIPTIONS

LETTERS	BHATTIPROLU	ARITTAPATTI	MADURA AND TINNEVELLY OTHER THAN ARITTAPATTI	SITTANNAVASAL	ARIKAMEDU	MAMANDUR
a initial						
ā medial	yā rā sā	chā lā	kā vā	nā kā	rā rā tā	tā
i initial						
i medial	di bi	ri	ri	chi	ti ti chi vi	yi
ī initial						
ī medial	shī				pī	
k	ka			kā	kai ke	ku
ñ						
ṭū						
m	(CRYSTAL)					mā
y	(CRYSTAL) yā					yi
r	ra					
l	(CRYSTAL)					lā
ḷ		ḷā	ḷi	ḷā	ḷā	
ḻ						
ṟ			ṟu ṟe ṟai	ṟā		
ṉ						

Fig. 45

actually should be relegated to a later period. If this assumption is correct then the so-called discrepancy between the palaeographic and the archaeological evidence would seem to disappear.'

3. *Palaeography* (see table, fig. 45)

(i) Comparison with the Mamandur inscription (ascribed conjecturally to the third century B.C.) shows a general similarity in the characters.

In this inscription, *ma* is of the angular variety, but at Arikamedu it is a loop with a cross-bar, as in the Śittaṇṇavāśal and other cavern inscriptions. The letter *ra* is a mere straight line at Arikamedu and in the cavern inscriptions of Madurā and Tinnevelly districts, but in the Mamandur record it is a slightly zigzag line. The other letters have practically the same shape in both.

(ii) The characters of the Arikamedu graffiti closely resemble the cavern inscriptions (pl. facing page 57 of the *Annual Report on South Indian Epigraphy* for 1912; pl. facing p. 86, ibidem for 1915; pl. facing p. 7, ibidem for 1918), with the following exception: the letter *ḷa* has a more circular form in the cavern inscriptions, whilst at Arikamedu it has the almost modern open form. This is a point in favour of a later date for the Arikamedu graffiti.

(iii) The Arikamedu characters are closely comparable with those of the Bhaṭṭiproḷu (Kistna District) Brāhmī inscriptions, which are conjecturally dated by Bühler to the 'time immediately after Aśoka or about 200 B.C.' (*Epigraphia Indica*, II, 329).

(iv) The Arikamedu inscriptions may further be compared with the Hāthibāḍā and Ghosuṇḍī inscriptions (*Epigraphia Indica*, XXII, 199ff., and XVI, 25ff.), attributed by Dr. D. R. Bhandarkar to 'the beginning of the first century B.C.' Slight differences are:—

In the Hāthibāḍā and Ghosuṇḍī inscriptions the arms of *a* on the left are a little round, while in the Arikamedu inscriptions they are angular.

In the former the cross-bar of *ka* is drawn above the centre of the vertical line, but in the latter it is at or a little below the centre.

In the former the bottom of *pa* is a little angular, while in the latter it is fully round.

In the former the letter *ma* has a more developed shape than in the latter.

The letter *va* has a flattened base in the former.

4. *Transliteration* (see figs. 46, 47; pl. XLI)

1. AK I-67 contains traces of six letters which are broken and cannot be definitely made out.
2. AK I-127. Reading is clearly *āṇ pīya makar*, meaning 'the dear son of..........ṇ'.
3. AK IV-198. This is one of the two Prākrit inscriptions. It reads *Yakhamitasa*, meaning 'of Yakhamita (Skt. Yakshamitra)'.
4. AK I-168. Two inscribed pieces, which do not dovetail into each other but may be portions of the same inscription. The smaller piece contains four letters from the beginning and reads *ātaṅka*, which cannot be interpreted. The third symbol, which also occurs at the end of the bigger piece, is read as *ga* by Dr. Chhabra, while Mr. Subrahmanya Aiyer takes it to be an earlier form of *ṅa*.

The bigger piece consists of nine symbols which may be read as *cha ṇa cha ṇa ṭe no ba tā* (or *ti*) *ga* but cannot be interpreted. Dr. Chhabra reads the fifth letter as *ṭa*, but in that case the horizontal stroke occurring on the top of this letter will be superfluous and has to be explained. This symbol as well as the last three letters of this fragment are all new to the southern Brāhmī script, and their exact phonetic value must await determination.

5. AK II-69. Mr. Aiyer reads as *Tavapiāḷar*, which appears to be a personal name.

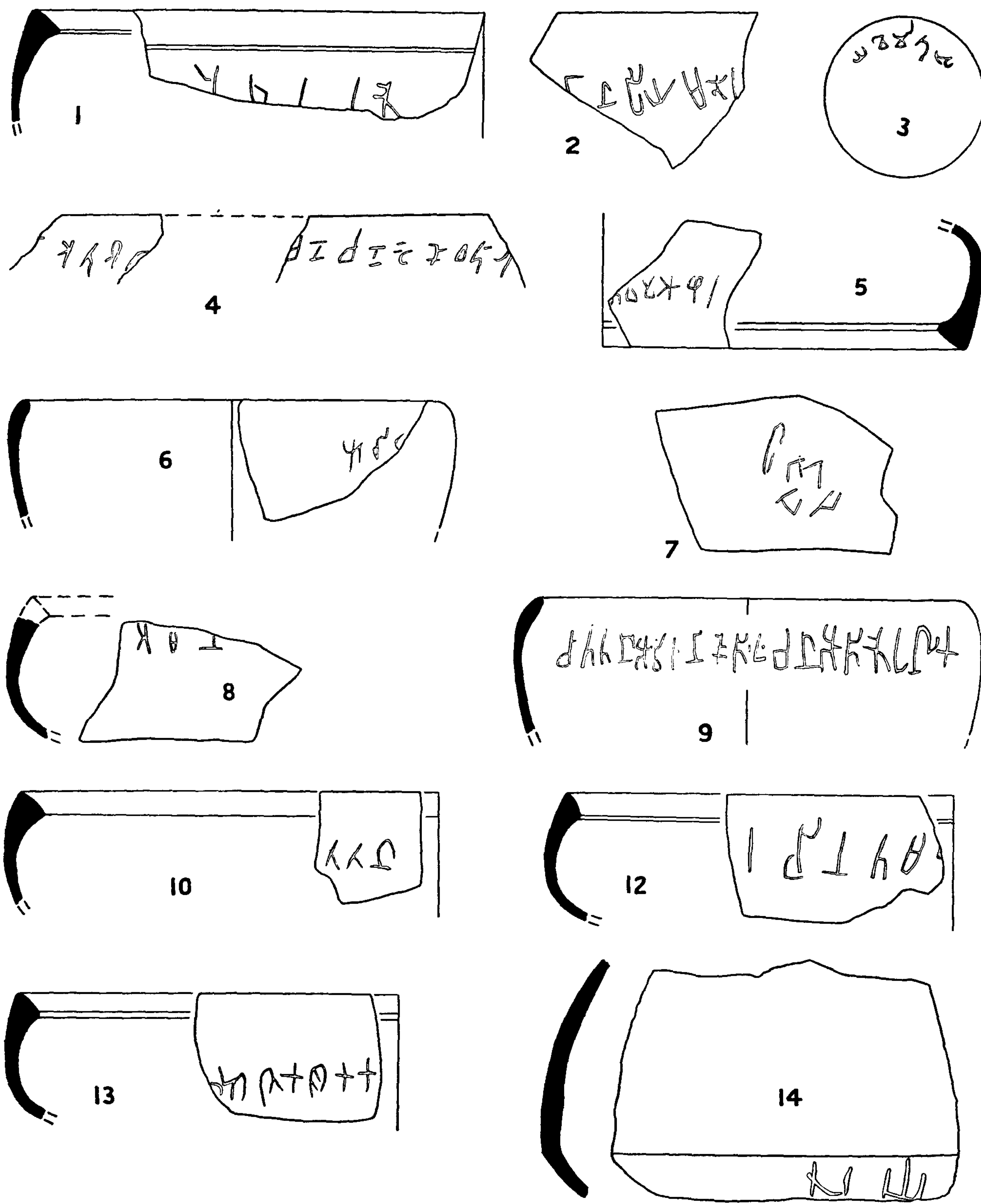


FIG. 46. *Graffiti on pottery.* ½

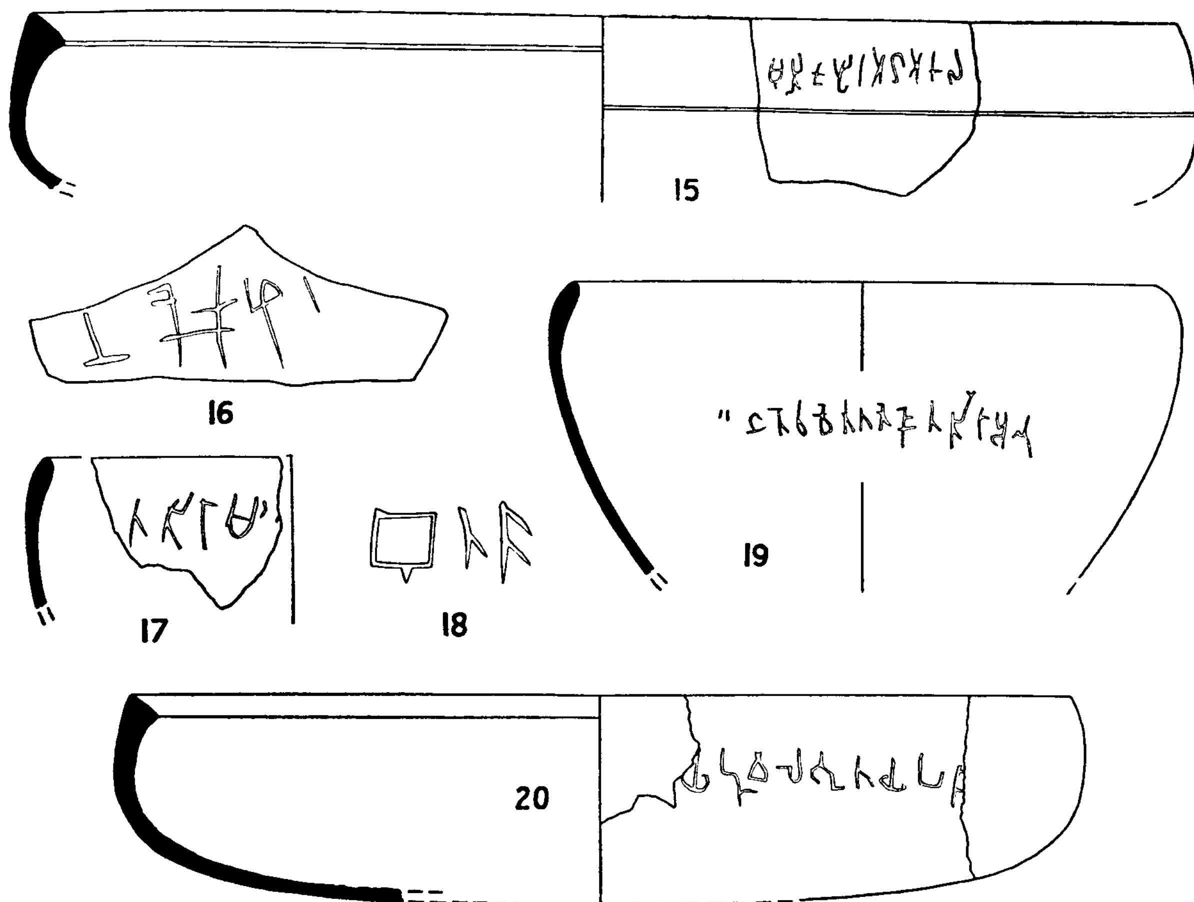


FIG. 47. *Graffiti on pottery.* ½

6. AK II-432. Mr. Aiyer reads these two letters as *āvi,* which indicates a personal name. The vowel *ā* here has a cursive form.

7. AK II-533 contains four symbols which appear to be only potter's marks.

8. AK II-562 reads *Āmaṉ,* which is a personal name.

9. AK II-571. Reading is *Chāttaṉ Āvi iṉ koti Īchaṉ Āditaipaṉ.* The word *koti* seems to denote some relationship (Skt. *gotrin?*) which is preceded and followed by a proper name and may be translated as 'Īchaṉ Āditaipaṉ, a relation of Chāttaṉ Āvi'. This record introduces a new form of *ī* and also shows a mark of punctuation at the end.

10. AK II-576. The extant portion reads *-ttaṉ* and indicates the end of a personal name.

11. AK III-67 contains remnants of three or four letters too fragmentary to be made out. Not illustrated.

12. AK III-89. Mr. Aiyer reads this as *ra chintam* and Dr. Chhabra as *ra chinabhama.* No sense can however be made of either reading.

13. AK IV-120. Reading is *ga ṟa ti ka śa ka ka.* Except the two *kas* the other letters are doubtful, but this inscription has its value as the final symbol showing *kka* would certainly suggest that the language is Tamil.

14. AK IV-194 contains two crude symbols which may be potter's marks.

15. AK IV-199. Reads *Mutikuḻuraṉ akal,* meaning 'the wide-mouthed pot of Mutikuḻuraṉ'.

16. AK IV-277. Reading is *-n kaikōḷar*, meaning '..... n the weaver'.

17. AK VII-27. Reading is *-ittirāma* or *-ttiramī*, the end of a personal name.

18. AK V-117. Three letters reading *buttā*, i.e. the Tamil form of Buddhā, the name of a woman.

19. Found in the French excavations, and now in the Pondicherry Bibliothéque. Reading seems to be ..... *ṇtēva vaittatai kotti rāalu* (?) and may mean 'having carved that which was bestowed by .... *ṇtēva*'. The sense is not certain though the language is decidedly Tamil.

20. Found in the French excavations, and now in the Pondicherry Bibliothéque. Reading is *Yadu*(?)-*valabhutaya pati* and the meaning seems to be: '(This is) the platter (*pātrī*) of Yaduvalabhuta (Yadubalabhūtā).' *Pātrī* (Skt.) or *pātti* (Pāli) means 'a shallow vessel', and the shape of the inscribed sherd is in conformity with this.

Prof. Nilakantha Sastri, who has published this inscription in the *Journal of the Madras University* (XIV, 3-4), takes *pati* in the sense of 'husband' or a contracted form of *patithāvita* ('established'). But the sense here suggested by Dr. Chhabra is perhaps correct.

The second letter in this inscription is not certain but the language is decidedly Prākrit. It is not certain whether the name of the lady was 'Yadubalabhūtā' or 'Balabhūtā of the Yadu family'.

Q. Bones

The Northern Sector, particularly the deposits of estuarine slime below the Arretine-producing strata (see above, p. 22), yielded a large number of bones, including three human ones. A report on their examination is given below.

Report on Human and Animal Remains

By

B. K. Chatterjee *and* H. K. Bose, *Anthropological Survey Laboratory*

As the gallery specimens and disarticulated bones of different animals of various ages preserved in the Indian Museum, Calcutta, were not available for comparison due to war conditions, a thorough examination of the bones submitted for report was not possible, and the work had to be restricted to the identification of individual bones with their respective Order and Species.

The degree of mineralization of the bones varies in the individual specimens. Thus, in specimens 13, 33, 34 the process of mineralization has gone to a considerable extent; in 8, 10, 11 and 12 it is appreciably less; whereas in the rest it has only commenced. The full extent of mineralization, however, can only be determined by a thorough chemical examination.

Apart from human relics, the animals identified include the following: (1) fowl, (2) turtle, (3) boar, and (4) cow, all edible animals; but it is difficult to determine the extent to which they were used as such. In some cases, however, there are marks of a sharp implement on the bone.

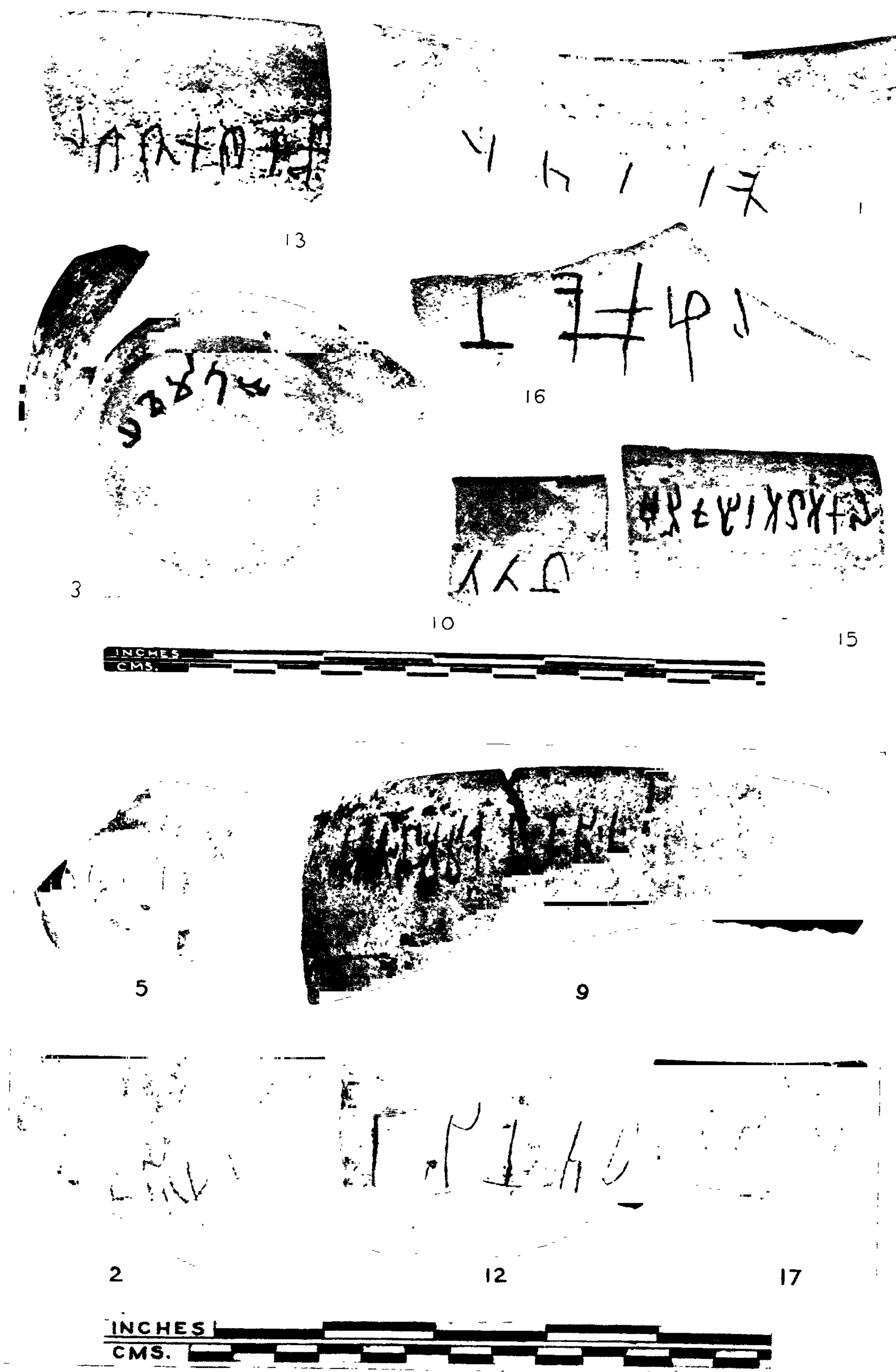
Most of the long bones such as femur, humerus and tibia, and other smaller bones such as metacarpal, metatarsal, phallange and calcanium, were found intact; the reconstructed skull of a boar (No. 4 below) and a few others, together with all the human bones, were fragmentary.

Classification of bones [1]

Class—Aves.
Order—Gallinae.
Genus—Gallus ferrugineus.[2]

1. Left femur of a fowl, complete.

[1] All the bones enumerated below were from the pre-Arretine layers of the Northern Sector, unless otherwise specified.
[2] W. T. Blanford, *The Fauna of British India, Birds* (1898), IV, 75.



Inscribed potsherds

Class—Reptilia.
Order—Chelonia.
Family—Trionychidae.
Genus—Lissemys punctata (Bonnaterre).[1]

2. Small fragment of the carapace of a turtle.

Class—Mammalia.
Order—Carnivora.
Family—Sudae.
Genus—Sus cristatus.[2]

3. Fragment of the right side of the mandible of a boar with two molars and one premolar. From a post-Arretine layer.
4. Mandible of a boar almost complete with two incisors, three premolars and three molars on the left side and one incisor and a portion of a canine and three molars on the right. From a post-Arretine layer.
5. Portion of the left side of the lower jaw with two molars. From an Arretine-producing layer.
6. Small fragment of the lower jaw with impressions of the roots of teeth. From a post-Arretine layer.
7. Portion of the right side of upper jaw with two molars and one premolar.

Class—Mammalia.
Order—Ungulata.
Family—Bos indicus linnaeus.[3]

8. Complete right humerus.
9. Fragment of the distal end of humerus.
10. Complete humerus.
11. Complete humerus of a young individual.
12. Almost complete humerus of a young individual. From an Arretine-producing layer.
13. Almost complete left scapula after reconstruction. From an Arretine-producing layer.
14. Fragment of the head of a scapula. From a post-Arretine layer.
15. Fragment of a scapula of a very young individual. From an Arretine-producing layer.
16. Fragment of the proximal end of the third and fourth metacarpal.
17. Almost complete third and fourth metacarpal of a young individual. From a post-Arretine layer.
18. Portion of the third and fourth metacarpal of a young individual.
19. Almost complete right femur after reconstruction. From an Arretine-producing layer.
20. Almost complete left tibia.
21. Complete third and fourth metatarsal.
22. Almost complete third and fourth metatarsal of a young individual.
23. Second phallange of the hind leg.
24. Premolar tooth with broken roots.
25. Molar tooth, roots partially broken. From an Arretine-producing layer.
26. Almost complete incisor tooth. From a post-Arretine layer.
27. Incisor, roots broken.
28. Calcanium of a very young individual.
29. Almost complete vertebrae of the hinder part of an adult individual. From an Arretine-producing layer.
30. Small fragment of a vertebra.
31. Fragment of a rib of an adult individual. From an Arretine-producing layer.
32. Fragment of a pelvis (?). Mark of a sharp implement present.

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[1] G. A. Boulenger, *The Fauna of British India, Reptilia and Batrachia* (1890), p. 17; B. Prashad, 'Animal Remains from Harappā', *Memoirs of the Archaeological Survey of India*, No. 51 (Delhi, 1936), p. 14; R. B. S. Sewell and B. S. Guha in *Mohenjodaro and the Indus Civilization* II (London, 1931), p. 663.

[2] W. T. Blanford, *The Fauna of British India, Mammalia* (1888–91), I, 560.

[3] Ibid., p. 483.

Class—Mammalia.
Order—Primates.
Sub-Order—Anthropoidae.
Family—Hominadae.[1]

33. Fragment of a left human mandible of an adult with two canines, four incisors, two molars and one molar with its cusps highly eroded. From an Arretine-producing layer.
34. Fragment of a left human mandible with two premolars and two molars of a young individual. From a post-Arretine layer.
35. Fragment of the shaft of a human fibula. Both ends broken. From an Arretine layer.

6. APPENDICES

Appendix I

Roman coins, first century B.C. to fourth century A.D., found in India and Ceylon

Opportunity is taken to print a revised list of identified Roman coins found in India and Ceylon, and to add a map (fig. 48), on which Arikamedu is also indicated although no Roman coins have yet been found there. The map emphasizes afresh the remarkable extent of the contact of South India with the western world during the Roman principate, implying incidentally a full use of the south-western monsoon. It would appear that the Roman traders found the smaller South Indian kingdoms more amenable or accessible than the large and powerful Āndhra kingdom of the centre, although the latter, with its abundant mineral resources, may be supposed to have taken some part in the business, and indirect cultural contacts with the Mediterranean (notably in the form of clay or metal *bullae* based vaguely on Roman coinage) are discovered there from time to time.

A notable feature of the map is the great cluster of coins, particularly hoards, of the first century A.D. in the Coimbatore district of the South. This may be partially explained by the ancient beryl mines in the district (p. 123); but it is probably more significant that at this point the Eastern Ghats swing westwards and terminate upon the line of the Western Ghats, and that the valley of the Ponnani carries a natural trans-peninsular highway immediately south of the abutment. This highway must have provided a useful alternative to the long coastwise route between the Malābār and Coromandel ports, although the numerous coin-hoards suggest that it was not free from peril in the broken country of the divide.

Coin list[2]

Bihar

1. Bāmanghāṭī, Singbhum Dist. (between Chaibāsa and Balasore, on the main road running W. from the port of Tamluk on the Hughli). Hoard of gold coins, including Gordian (*d.* A.D. 244). A. Cunningham, *Archl. Survey Rep.*, XIII (1882), 72.

Bombay Presidency

2. Dharphul, Sholāpur Dist. 18 aurei, Commodus—Severus (*d.* A.D. 211). *Num. Chron.* 1st S.,V (1843), 202; *Bombay Gazette*, Jan. 31, 1842; W. Elliot in *Madras Journ. of Lit. and Sc.*, XIII (1844), 215.

[1] W. T. Blanford, *The Fauna of British India, Mammalia*, I (1889–91), 3; Reynolds, *The Vertebrate Skeleton* (Sidney, 1913), p. 47.

[2] I gladly acknowledge help from Mr. T. G. Aravamuthan in the revision of this list.

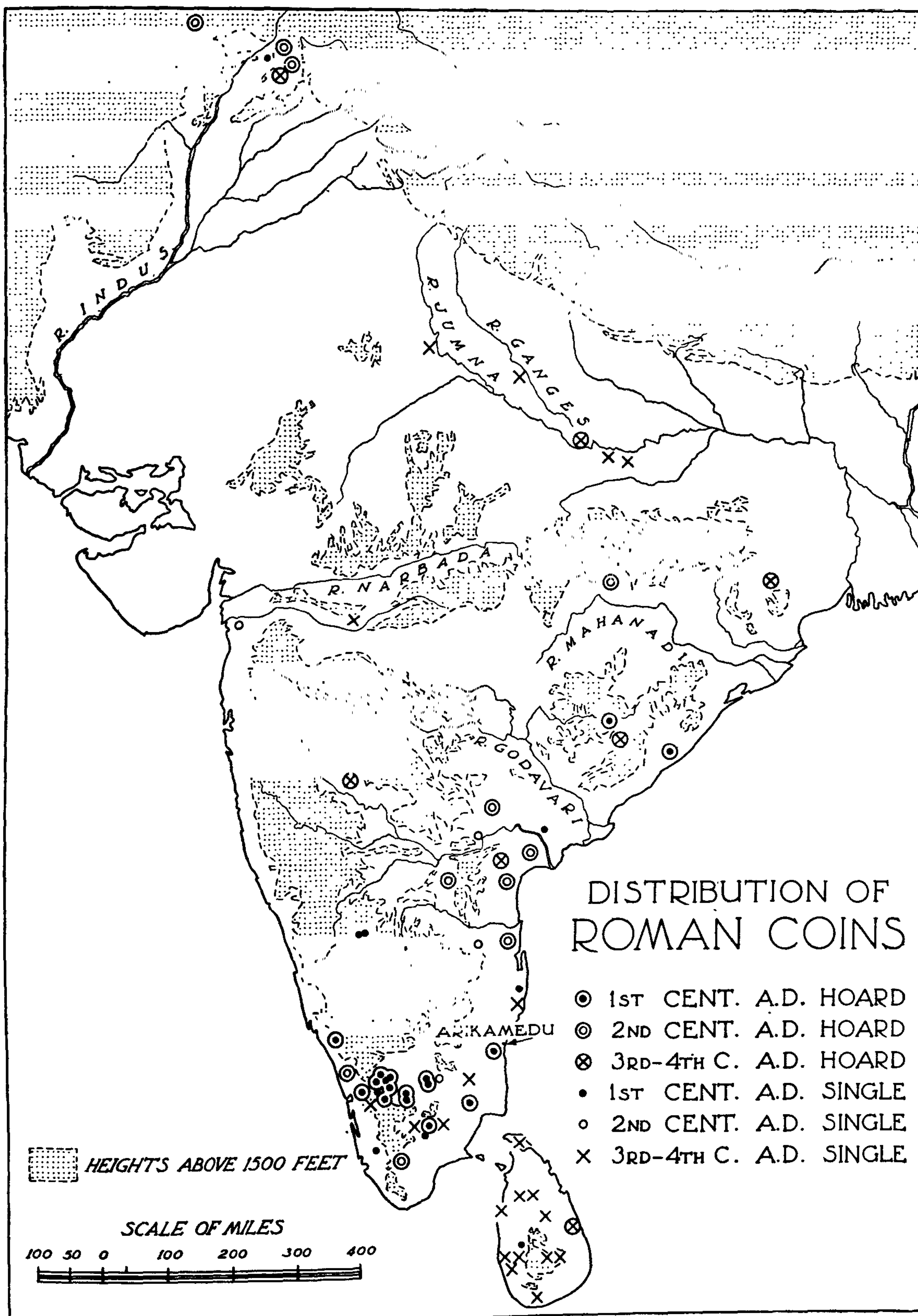

R. INDUS
R. JUMNA
R. GANGES
R. NARBADA
R. MAHANADI
R. GODAVARI
ARIKAMEDU
DISTRIBUTION OF
ROMAN COINS
1st CENT. A.D. HOARD
2nd CENT. A.D. HOARD
3rd-4th C. A.D. HOARD
1st CENT. A.D. SINGLE
2nd CENT. A.D. SINGLE
3rd-4th C. A.D. SINGLE
HEIGHTS ABOVE 1500 FEET
SCALE OF MILES
100 50 0 100 200 300 400

FIG. 48

3. Nagdhara, Jalālpur Tk., Surat Dist. Aureus of Lucius Verus (A.D. 166-7). O. Codrington in *Journ. of the Bombay Branch of the Roy. Asiatic Soc.*, XVIII (1890–4), 30–8.
4. Waghoda, Raver Tk., East Khandesh Dist. Aureus of the Severi (A.D. 202–20). O. Codrington in *J.B.B.R.A.S.*, XVIII (1890–4), 38.

Central Provinces

5. Chajerbedha, Bilāspur Dist. 2 aurei of Commodus (*d.* A.D. 192). Information supplied through Mr. T. G. Aravamuthan.

Madras Presidency

6. Athirāla, Pullampet Tk., Cuddapah Dist. Aureus of Trajan (*d.* A.D. 117). W. Elliot in *Madras Journ. of Lit. and Sc.*, 1844, pp. 214-5; and in *Ind. Ant.*, II (1873), 241-2.
7. Coimbatore Dist. Denarius of Augustus (*d.* A.D. 14). W. Elliot in *Madras Journ. of Lit. and Sc.*, XIII (1884), 214; *Num. Chron.*, I (1843-4), 162; J. Bird in *J.B.B.R.A.S.*, I (1883), 293ff.
8. Coimbatore Dist. 2 denarii of Tiberius (*d.* A.D. 37). *Madras Mus. A. Rep.*, 1912, pp. 4, 9.
9. Gumāda, Jeypore Tk., Vizagapatam Dist. 23 Roman gold coins, ending with Constantine the Great (*d.* A.D. 337). *Madras Mus. A. Rep.*, 1928, p. 4.
10. Kaliyamputtur, Madurā Dist. (near boundary of Madurā and Coimbatore Dist.). 63 gold coins in a pot, Augustus—Nerva (*d.* A.D. 98). *Madras Journ. of Lit. and Sc.*, XVII (1856-7), 114, and XIX (1857-58), 157-8.
11. Karivalamvandanallur, Sankaran Koyil Tk., Tinnevelly Dist. Six aurei, latest of Hadrian of A.D. 118. *Madras Mus. A. Rep.*, 1933, p. 5.
12. Karur, Trichinopoly Dist. About 500 coins, Augustus—Tiberius (*d.* A.D. 37) in a pot. H. Little in *Madras Christian College Mag.*, I (1883), 219–26; *Madras Mus. A. Rep.*, 1893, pp. 6-7.
13. Karur, Trichinopoly Dist. 5 aurei, including one of Claudius (*d.* A.D. 54). W. Elliot in *Madras Journ. of Lit. and Sc.*, XIII (1884), 214.
14. Karur, Trichinopoly Dist. Aureus of Marcus Aurelius (*d.* A.D. 180). R. Sewell in *J.R.A.S.*, 1904, p. 617.
15. Karuvur, Coimbatore Dist. Hoard of aurei, Augustus—Claudius (*d.* A.D. 54). Thurston, *Madras Gov. Mus. Cat. Coins* No. 1 (1874), p. 1; No. 2 (1888), p. 8. *Madras Journ. of Lit. and Sc.*, XIII (1884), p. 214.
16. Karuvur, Coimbatore Dist. Large hoard of denarii, Augustus—Tiberius (*d.* A.D. 37), in a pot. Thurston, *Madras Gov. Mus. Cat. Coins* No. 2 (1888), p. 21; *Madras Christian College Mag.*, October, 1883, pp. 219ff.
17. Kattanganni, Dharapuram Tk., Coimbatore Dist. 233 denarii, Augustus—Tiberius (*d.* A.D. 37). *Madras Mus. A. Rep.*, 1913, pp. 4, 8.
18. Kotpad, Jeypore Tk., Vizagapatam Dist. 4 Roman denarii, Augustus—Tiberius (*d.* A.D. 37). *Madras Mus. A. Rep.*, 1915, pp. 5, 6.
19. Kottayam, Malabar Dist. Large hoard of aurei, Augustus—Nero (*d.* A.D. 68). *J.A.S.B.*, XX (1851), 371–87; R. Caldwell, *A Description of Roman Imperial Aurei found near Calicut*, Trivandrum (1851); *Madras Mus. A. Rep.*, 1882, p. 5.
20. Kulattuppalaiyam, Dharapuram Tk., Coimbatore Dist. Aureus of Theodosius (*d.* A.D. 395). *Madras Mus. A. Rep.*, 1934.
21. Madurā town. 11 Roman gold coins ending with Nero, dated A.D. 61-2. *Madras Mus. A. Rep.*, 1917, pp. 4, 5, 8.

22. Madurā town. Stray finds of copper coins, including Honorius and Arcadius (*c.* A.D. 400). R. Sewell, *List of the Antiquarian Remains in the Presidency of Madras*, I (1882), 291.
23. Madurā Dist. Aureus of Domitian (*d.* A.D. 96). *Madras Gov. Mus. Cat. Coins*, No. 2 (1894), p. 29.
24. Mahābalipuram, Chingleput Dist. Coin of Theodosius (*d.* A.D. 395). J. Prinsep in *J.A.S.B.*, I (1832), 406.
25. Mahābalipuram, Chingleput Dist. Coin possibly of Theodosius, late fourth century. *Arch. Sur. India, Southern Circle, A. Rep.*, 1888, pp. 2–4, 5.
26. Mallayapalem, Guntur Dist. 4 Roman aurei, ending with Antoninus Pius (*d.* A.D. 161). *Madras Mus. A. Rep.*, 1915, pp. 4, 5, 6.
27. Mambalam, Madras city. Coin of Augustus (*d.* A.D. 14). *Madras Mus. A. Rep.*, 1930, p. 6, and 1931, p. 2.
28. Nāgārjunīkoṇḍa, Palnad Tk., Kistna Dist. Gold coin of Hadrian (*d.* A.D. 138). *Arch. Sur. India A. Rep.*, 1936-7, p. 61.
29. Nandyal, Kurnool Dist. Upwards of 52 gold coins, ending with Antoninus Pius (*d.* A.D. 161), in a pot. *Madras Mus. A. Rep.*, 1935, p. 5.
30. Nellor. Hoard of Roman coins in a pot, latest recorded a coin of Antoninus Pius (*d.* A.D. 161). Davidson in *Asiatic Researches*, II (1790), 331-2.
31. Ongole Tk., Guntur Dist. Hoard of coins of which two gold solidi of Nero and Hadrian (*d.* A.D. 138) are recorded. *Madras Mus. A. Rep.*, 1905, pp. 5 and 8.
32. Pennar, Coimbatore Dist. Denarius of Augustus. W. Elliot in *Madras Journ. of Lit. and Sc.*, XIX (1888), 228.
33. Pollachi, Coimbatore Dist. Hoard of denarii in a pot, said to be Augustus—Tiberius (*d.* A.D. 37). *Indian Antiquary*, IV (1875), 302; F. Buchanan, *A Journey from Madras*, II (1807), 318-9.
34. Salihundam, Chicacole Tk., Vizagapatam Dist. 11 denarii of Tiberius (*d.* A.D. 37). *Madras Mus. A. Rep.*, 1899, pp. 5, 9.
35. Tanjore. Silver-washed coin of Diocletian (*d.* A.D. 305). *Madras Mus. A. Rep.*, 1937, p. 7.
36. Tondamanathan, Cuddalore Tk., South Arcot District. 6 Roman gold coins, Tiberius—Nero (*d.* A.D. 68). *Madras Mus. A. Rep.*, 1918, pp. 3, 7.
37. Vellalur, Coimbatore Dist. 'A find of silver denarii', *Madras Mus. A. Rep.*, 1891, p. 8; E. Thurston in *Num. Chron.*, 1891, pp. 199–202; *Madras Mus. Catalogue of Coins* No. 2 (1894), p. 24.
38. Vellalur, Coimbatore Dist. 121 denarii of Augustus (*d.* A.D. 14). *Madras Mus. A. Rep.*, 1932, pp. 8, 9.
39. Vellalur, Coimbatore Dist. 522 denarii, Augustus—Claudius (*d.* A.D. 54) in a pot. W. Elliot in *Madras Journ. of Lit. and Sc.*, XIII (1844), 212–4; J. Bird in *J.B.B.R.A.S.*, I (1843), 294.
40. Vidiyadurrapuram, Bezwada Tk., Kistna Dist. Denarius of Tiberius (*d.* A.D. 37). *Arch. Sur. of India, Southern Circle, A. Rep.*, 1888, pp. 2–4, 5.
41. Vinukonda, Guntur Dist. 15 Roman gold coins, ending with Caracalla (*d.* A.D. 217). *Num. Chron.* 3rd S., IX (1889), 325–8.

Punjab, N.-W. Frontier Province and Afghanistan

42. Jalālābād, Afghanistan. In the Ahin Posh stūpa, with Kushan coins, were 3 Roman aurei, the latest of Antoninus Pius (*d.* A.D. 161). Waterhouse in *Pr. of the Asiatic Soc. of Bengal* (1879), pp. 77–9; A. F. R. Hoernle, Ib., pp. 122, 134-5.

43. Manikyālā, Rawalpindi Dist., Punjab. 5 aurei, latest of A.D. 158-9. A. F. R. Hoernle in *Pr. A.S.B.*, LIII (1886), 86–9.
44. Manikyālā, Rawalpindi Dist., Punjab. 7 worn Republican denarii of the first century B.C., with Kushan coins of first-second century A.D. A. Court in *Journ. of the Asiatic Soc. of Bengal*, III (1834), 558-9; J. Prinsep, Ib., 564-5; A. Cunningham, Ib., 635–7.
45. Pakli, Hazara Dist., N.-W. Frontier. Hoard of denarii, the latest known being one of Hadrian (*d.* A.D. 137). *Num. Chron.* 3rd S., XIX (1889), 263.
46. Taxila, Rawalpindi Dist., Punjab. Denarius of Tiberius (*d.* A.D. 37). *Arch. Sur. India A. Rep.*, 1935, pp. 29-30, 83.

United Provinces

47. Allahabad. Coins of Diocletian (A.D. 283–93). J. Prinsep in *J.A.S.B.*, I (1832), 476.
48. Chunār, Mirzāpur Dist. Copper coin of Numerianus (A.D. 283). J. Prinsep in *J.A.S.B.*, I (1832), 392–408, 476.
49. Kanauj, Kanauj Tk., Farrukhābād Dist. Copper coin of Diocletian (A.D. 283–93). H. H. Wilson in *Asiatic Researches*, XVII, 561; J. Prinsep in *J.A.S.B.*, I (1832), 476.
50. Mathurā (Muttra). Gold coin of Caracalla (*d.* A.D. 217). Information from Curator of Curzon Museum, Mathurā.
51. Mirzāpur. Coin of Carinus, minted A.D. 283-4. *J.A.S.B.*, I (1832), 392–408, 476.

Cochin State

52. Eyyal, 22 miles N.-W. of Trichur. Found on the slope of a hill east of the village in an earthenware pot, 1945. 12 gold coins: of Trajan (Cos II), 1; Nero, 2; Claudius, 1; Tiberius, 8. About 50 silver coins, late Republican—Augustus. Also about 12 silver punch-marked coins, with some unstamped pieces of silver. Date of deposit, *c.* 100 A.D.; the Roman silver and the punch-marked coins are much worn, whereas the aurei are fresh. Information and photographs from the State Archaeologist, Cochin State.

Hyderabad State

53. Gaiparti, Suriapet Tk., Nalgonda Dist. 3 Roman gold coins, latest of Antoninus Pius and dated A.D. 140–4. *A. Report of Arch. Surv. of the Nizam's Dominions*, 1933, pp. 7, 39.

Mysore State

54. Chandravalli, Chitaldrug Tk. Denarius of Augustus (*d.* A.D. 23). *Arch. Surv. Mysore A. Rep.*, 1909, p. 30.
55. Chandravalli, Chitaldrug Tk. At least two denarii of Tiberius were found here in 'Excavation 15' in 1929 and are now in the Mysore Museum. They have not been published, but there is apparently a reference to one of them in *Excavation at Chandravalli, Supplement to the Annual Report of the Mysore Archaeological Department*, 1929 (pub. 1931), p. 25.
56. Yaswantpur, Bangalore Dist. 163 denarii, Augustus—Claudius (*d.* A.D. 54), in a pot. L. Rice, *Find of Roman Coins near Bangalore* (1891); and E. Thurston, *Madras Govt. Mus. Cat. Coins* No. 2 (1894), pp. 26–8.

Pudukkottai State

57. Karukkakkuriochi, Alangudi Tk. Hoard of aurei, ending with Vespasian (*d.* A.D. 79). G. F. Hill in *Num. Chron.*, III, XVIII (1898), 304–20; G. G. Rodgers, Ib., III, XIX. (1899), 263–5.

Travancore State

58. Poonjar, about 150 miles north of Trivandrum. Gold coin of Augustus, found 1945. Early first century A.D.

Ceylon [1]

59. Ampitiya. Coin of Arcadius (*d.* A.D. 408).
60. Anurādhapura. Coins of Theodosius, Arcadius and Indo-Roman coins in various places.
61. Attikuli, in Mannar Dist. Constantius, Theodosius and Arcadius.
62. Badulla. Coins of Aurelian and Arcadius.
63. Balapittya. Hoard of fourth century coins down to Arcadius.
64. Batticaloa. 5 coins of Arcadius and Honorius (*d.* A.D. 423).
65. Boragoda. 40 coins, Constantius II—Honorius.
66. Colombo. Many coins, Constantine II—Honorius.
67. Gintota. 6 of Constantine II, Arcadius and Honorius.
68. Hikkaduwa. 17 coins, Constantius II—Arcadius.
69. Kalmunai, Eastern Provinces. Arcadius or Honorius.
70. Kalpitiya. Coin of Honorius.
71. Kantarodni, in Jaffna peninsula. 150 fourth century bronze down to Honorius.
72. Kitalagama. Coins of Theodosius and Arcadius.
73. Kolugala, in Turpana. 220 coins, Constantine I—Honorius.
74. Kurunegala Dist. Coins of Nero and Vespasian.
75. Mantota. Antonine coins.
76. Matara. Coin of Maximian II.
77. Pandirippu, Eastern Province. 1 fourth century coin.
78. Pidarikulam, Giant's Tank. Coins of Gratian and Valentinian II or Theodosius I.
79. Sigiriya. 1,675 fourth century coins down to Honorius.
80. Udappu. Coins of Theodosius and Arcadius or Honorius.

Appendix II

Semi-precious stones [2]

(Map, fig. 49)

Of precious stones, diamonds, rubies and sapphires were obtained in India for the Roman market: the first presumably from the Cuddapah and Kurnool system of the Deccan and the Vindhyan system of the centre; rubies probably from Ceylon, Salem and Mysore in southern India, and possibly Rewa in central India; sapphires also from Ceylon, Salem and the upper Godāvarī. More extensive was the trade in Indian pearls, fished chiefly in the Palk Strait and the Gulf of Mannār, between Ceylon and the mainland, where the port of Kolkhoi served as a primary depot.

[1] See H. W. Codrington, *Ceylon Coins and Currency* (Colombo Museum, 1924); and J. Still in the *Journ. of the Royal Asiatic Soc.* (Ceylon Branch), XIX (1907).

[2] Information from the Geological Survey of India, and from J. Coggin Brown, *India's Mineral Wealth* (Oxford, 1936), pp. 283ff.

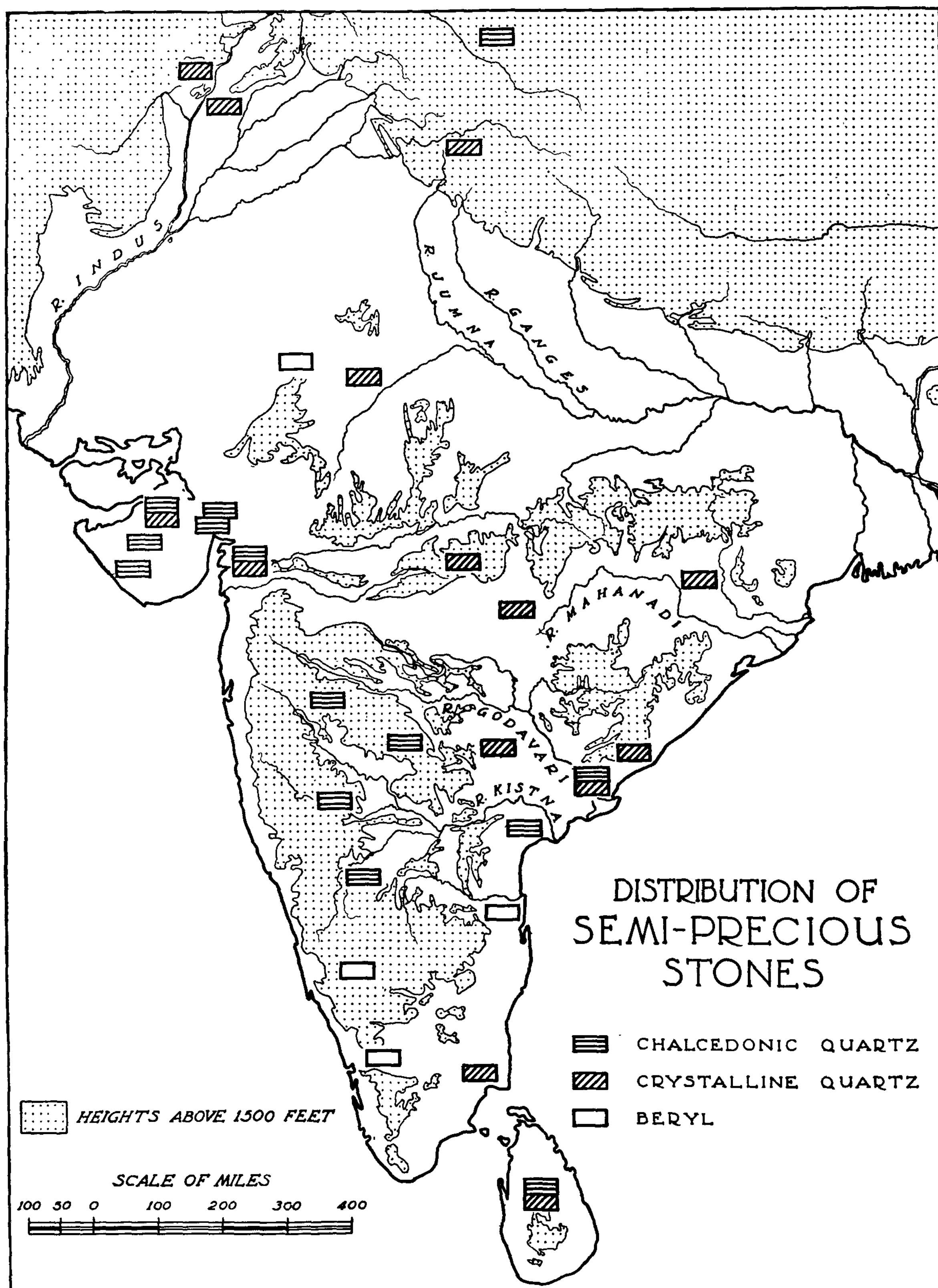

DISTRIBUTION OF SEMI-PRECIOUS STONES
CHALCEDONIC QUARTZ
CRYSTALLINE QUARTZ
BERYL
HEIGHTS ABOVE 1500 FEET
SCALE OF MILES
100 50 0 100 200 300 400
R. INDUS
R. JUMNA
R. GANGES
R. MAHANADI
R. GODAVARI
R. KISTNA

FIG. 49

At Arikamedu these precious materials have not yet been recorded. There, apart from glass and clay, the substances most extensively used for the manufacture of beads are chalcedonic and crystalline quartz. Beryl, though mined anciently and within easy reach, has not actually been identified at Arikamedu, but the omission may be accidental. The quartzes occur in a number of sub-varieties, of which agate, carnelian, onyx, jasper, rock-crystal and amethyst are the commonest. They are of widespread occurrence in India but, save for a prolific area in Gujarāt, tend to concentrate on the eastern slopes and foot-hills of the great central massif, and may thus have been a factor in the extension of Roman trade up the east coast. The principal source of beryl was at Padyur in the Coimbatore District, which lies conveniently near the divide between the eastern and western coasts. Indeed the valley of the Cauvery or Kāverī river, listed by Ptolemy as the Khabēros, links it directly with his 'Khāberis emporion', identifiable with Kāverīp-paṭṭinam or Puhār, at the mouth of the river some 60 miles south of Arikamedu. It is probably significant that more early Roman Imperial coins have been found in the Coimbatore District than in any other part of India (see p. 116).

The main sources of these semi-precious stones are as follows:—

1. *Chalcedonic quartz*

Agate, carnelian, onyx and jasper occur largely in the amygdaloidal lava flows of the Deccan and Rājmahāl Trap. The most important centres are in Gujarāt, but the stones occur also in Kāthiāwār, Kashmīr, Bihār, and near Guntūr in the Madras Presidency. The principal sites are:—

Cambay and Ahmedābād.
Rājpiplā State.
Kāthiāwār (Tānkāra, Morvī State, Khokhri, Latipur, Badampur, Khakra).
Kashmīr (Kyamgo Traggar).
Hyderabad State (freely in the Deccan Trap).
Madras Presidency (alluvium of Kistna river near Guntur; and in the Godāvarī near Rājāhmundry).
Sunder State (Jaipur near Timappaghur).
Ceylon.

2. *Crystalline quartz*

Rock-crystal, cairngorm, cat's eye and amethyst occur notably as follows:—

Punjab (Aurangpur, Miānwali, Kālābāgh and Bashahar).
Kāthiāwār (Tankara, Morvi State).
Jaipur State (Nawai).
Tonk State (Hathuna).
Rājpiplā State.
Orissa (Sambalpur).
Central Provinces (Chindwara, Khairi).
Hyderabad State (Warangel).
Madras Presidency (Godāvarī near Rājāhmundry, Vizagapatam, Tanjore, Sanda-mandapuram).
Ceylon.

3. *Beryl*, which, with its bluish-green variety, aquamarine, may be ranked above the quartzes as a gem-stone, was, as mentioned above, long mined near Coimbatore in the Madras Presidency. It occurs also elsewhere, notably in mica-bearing pegmatites at

Govindsagar, Kishangarh State, in Rājputāna, near Nellor (Madras Presidency), and near Melkot (Mysore State).

APPENDIX III

The ancient name of Arikamedu

The *Periplus of the Erythraean Sea*, after referring to Kolkhis or Korkai, the ancient pearl-port near the southern end of India, mentions the three principal markets and anchorages to which resorted the merchants of 'Limurikē', probably the region otherwise known as 'Damirika' (the Peutinger Table) and 'Dimiricā' (the Ravenna Geographer) and etymologically equivalent to the *Tamil*-land. The three ports, 'in the order in which we have named them' (from the context, south to north), are *Kamara*, *Podoukē*, and *Sōpatma*. Ptolemy (VII, 1, s. 14), after referring to 'the mouth of the river Khabēros', clearly the Kāverī, and *Khabēris emporion*, which may safely be identified with Kāverīpaṭnam or Kāverīppaṭṭinam, the modern Tranquebar, familiar in Tamil literature as a port frequented by foreign merchants (see above, p. 19), mentions *Sabouras emporion* (unidentified) and *Pōdoukē emporion*. He also is working northwards, so that *Pōdoukē* must be somewhere to the north of Kāverīpaṭnam. Whether, as Müller suggested, Ptolemy's *Khabēris* should be equated with the *Kamara* of the *Periplus* is less certain; but the *Sōpatma* of the *Periplus* has with some plausibility been identified with the Sō-paṭṭinam of Tamil literature, the modern Markāṇam, on the coast between Pondicherry and Madras.[1]

All that can be inferred from this is that the geographical position of Arikamedu (Pondicherry) is consistent with the general indications given for Podoukē or Pōdoukē by the *Periplus* and Ptolemy. The site lies 60 miles north of Tranquebar and 20 miles south of Markāṇam. Moreover, Pondicherry is a European corruption of *Pudu-chchēri*,[2] meaning 'Newtown', and it can at least be claimed that the Greek *Podoukē* is as near to this as is the modern French *Pondichéry*.

There the evidence at present ends. But the new identification of a Roman emporium in the immediate vicinity of Pondicherry gives a fresh and perhaps conclusive weight to the equation of Podoukē with Pondicherry which has already been suggested by more than one writer.[3]

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1 K. A. Nilakanta Sastri, *The Cōḷas* (University of Madras, 1935), I, 30.

2 *Hobson-Jobson* cites an English reference to the place in 1680 with the spelling 'Puddicherry'.

3 See W. H. Schoff, *The Periplus of the Erythraean Sea* (London, etc., 1912), p. 242.

ARCHAEOLOGICAL PLANNING FOR INDIA: SOME OF THE FACTORS

The Presidential Address given by the Director General of Archaeology in India to the section of Anthropology and Archaeology at the Bangalore meeting of the Indian Science Congress in January 1946, and here reprinted by permission, deals briefly with certain of the factors which call for consideration in the planning of archaeology as an organized science in India. Although the ideal solution of the problem would be the establishment of a properly equipped Indian Institute of Archaeology on the general lines of some of the American institutes, much could be done by the coordination and development of existing facilities. Until one or other of these advances has been achieved, it will not be possible for archaeological research in India to attain the high international position which the astonishing wealth of India's cultural heritage both justifies and demands.

A congress of scientists such as that which has brought us together in this room to-day has diverse duties and uses. It is a focus of academic gossip, a bazaar of ideas and aspirations, a shop-window of recent achievement. But if it is to fulfil its task worthily, it is at the same time something more than that. It is above all a representative planning-committee. To-day, the world is full of planning-committees. Few of the many plans will achieve actuality, and, of those that do, fewer can be expected to achieve their real intention. Let us not on that account cease to plan. A mountain which produces only a mouse is livelier than a mountain which produces nothing at all.

I ask therefore that for the next three-quarters of an hour we indulge in a little serious planning. The other day I had occasion to remark to a committee of the Central Legislature that, as an archaeologist, I was concerned with the future rather than with the past. I was gently corrected, but my words were correct. In India, archaeology and anthropology have admittedly all too little behind them. There have been archaeologists and anthropologists in this country, but no coherent *science* of archaeology and anthropology has ever been established here, such as has been partially established in western Asia, in Europe and in America or such as was growing up in China before the barbarous devastation of that country in the name of progress. Indian humanistic science has been relegated largely to the future. But the future of India is now close upon us. It is time not only to plan but to act.

If we are to plan and to act with a whole mind and heart, we must begin from an unreserved conviction that what we are doing is really worth while. To narrow the issue, are archaeology and anthropology worth while? What indeed is the function of these sciences?

The answer is not difficult. They are sciences of interpretation. What then do they interpret? They interpret an endless succession of unique achievements of the human brain, unique reactions of the human consciousness to a multitude of combining or conflicting circumstances. Let me emphasize that word 'unique'. History never repeats itself. Its episodes are, each of them, the product of momentary conditions imposed by geographical and geological environment, climate, 'race', tradition, 'accident', a hundred and one factors which, added to the incalculable qualities of the human spirit itself, can never be expected to recur in identical form in the lifetime of mankind. They are each of them unique. The Altamira cave-paintings, the Parthenon, Chartres Cathedral, the Ajaṇṭā caves, the great temple of Tanjore, the Tāj Maḥāl, are each expressions of a *Zeitgeist* which is insusceptible to repetition, unique.

But there is more to it than that. I have just spoken of 'episodes' of human history. That is a convenient but misleading word. The term 'episode' suggests a degree of incidental detachment which does not in fact exist. The episodic treatment of history is a necessary artifice in the educational curriculum, but requires constant and specific correction. Without its context, the episode lacks perspective and significance. At the risk of labouring the obvious, I suggest a simple analogy. Suppose that all the words on a page of this book were loose, and that by shaking the page I could shake them into a heap on the floor. All the words, the 'episodes', would be there, but their sequence and their meaning would be completely lost. Some system, some discipline, is required to rearrange them in their significant sequence and so to restore their meaning. In the tumbled episodes of human history and prehistory that is the task of the humanistic sciences; of the historian, the archaeologist, the anthropologist. Their final function is the coordination of the works of man and the interpretation of these as an articulated and significant entity: their task, or a part of it, is to restore the fallen words to the page of the book, so that he who runs may read.

Thus it may, I suppose, be said that we, in our study of the works and days of man, have a twofold mission to fulfil. We must first set ourselves to analyze the individual works themselves with the patient objectiveness of the scientist; and secondly, we must attempt to interrelate them, place them in their wider human context, and re-endow them, in short, with something of the three-dimensional vitality which created them. In the one rôle we are cold and calculating scientists, in the other we have or should have something of the imaginative comprehension of the artist. But let it be emphasized that the sequence of thought and effort is strictly in that order: first analysis, secondly reconstruction, the former always leading and controlling the latter.

Now this dual task is a complex and exacting one. That it is nevertheless 'worth while' cannot be doubted by anyone who has sufficient respect for man to value the faculty which exalts him above the other animals. Let us remember again that the subject-matter of history, archaeology and anthropology is the expressed reaction of the human brain, in a succession of manifestations which cannot recur, to the physical and spiritual problems of existence. To exclude these reactions and manifestations from our thoughts is to deny a great part of our manhood and to become, however disguised, little more than human piedogs scrounging perennially for the next meal.

The three sciences which I have named are not, therefore, mere academic luxuries. They are basic necessities in any society which has sufficiently emerged from the animal-stage to experience a sense of intelligent curiosity about itself. They are, above all, not merely the prerogative of a few specialists and cranks whose enthusiasms are private to themselves; they are, or should be, in some degree a part of the intellectual equipment of every educated man and woman. I would beg those of us who are professed archaeologists or anthropologists to bear this constantly in mind. Our duty is not restricted to a narrow circle of professors; we shall fall sadly short of that duty if we do not interpret also for the lay folk who are, equally with us, the co-heirs of the same inheritance.

On the present occasion, however, we are a congress of scientists, and for the most part indeed I have referred to archaeology and anthropology as *sciences*. True, a few moments ago I suggested that we should in some degree aspire to be artists also. But to-day science is more fashionable than art. We are inclined to use the word science freely and sometimes rather loosely, and it is perhaps as well, before we consider the question of future planning, to determine a little more precisely the category of learning with which our special subjects are to be grouped.

It is fair to say that modern archaeology and anthropology are on the one hand increasingly employing the methods of natural science, and on the other hand increasingly

employing the natural sciences themselves. Whether it is altogether true to say, quite bluntly, that they are themselves sciences in the normal sense of the term, I am less certain. They are, at the best, *inexact* sciences. For the mind can never wholly comprehend itself. The geologist can objectify his rock and (within the far-off boundaries of ultimate causes) can completely encompass it. The astronomer can even reduce the universe to objective mathematical and chemical formulae. But it is inevitable that to the mind, dealing with itself, a strong subjective element shall always be present. There is on earth no impartial arbiter of humanity. Humanistic science is fated to be an inexact science.

Accepting this regrettable conclusion, we need not as scientists despair of our estate. We have yet a very long way to go before, in our human studies, we attain the limits of objective truth and impend unsupported upon the abyss of subjectivity. Our discipline is primarily a science. Or, rather, it is a *synthesis of sciences*; and in our planning, at which I have now at least arrived, that is the controlling and informing factor. The problem to-day is primarily and urgently this; how are we in India to harness the natural sciences in the service of the study of man? How are we to create or coordinate the academic apparatus necessary for the analysis and objective understanding of his variegated achievement and environment through the ages?

Let us glance at the dimensions of our problem. In reconstructing the reactions of man to circumstance and experience, we have first to set the stage, to reconstitute the physical environment of his thoughts and deeds. The plan of his environment is the province of *geography*; the cross-section of his environment is the province of *geology*. The changing climate which apportions his working year and may involve vast movements of population make *climatology* an essential study. The plants which obstruct or aid his progress, feed or warm him, bring *botany* largely into the picture. The baffling but crucial problem of human 'races', and of the sequence of faunas which have in varying degree conditioned human economy, introduce *biology* into our day's work. And now *chemistry* and *physics* have become our handmaids and will have an increasing share in certain of our studies. A formidable gathering of natural science has rallied round the science of man; and without it to-day the science of man has no meaning. Let me stress this with all possible emphasis; archaeology and anthropology can no longer be fobbed off with an odd lecture here and there in the arts curriculum. They have become *faculties* rather than departments of knowledge. This is a basic factor in our planning, and, before going further, I will pause for a moment to amplify a little the actual contributions which natural science makes to-day to humanistic science.

First, let us take geography. In India, the study of what may be called human geography has not begun. Years ago attention was drawn to the subject in an excellent short paper in the *Indian Antiquary*,[1] but this momentary lead has not been followed. And yet, of all regions of the world, India, with its combined continental and peninsular characters, its alluring coastal tracts, its great rivers, its vast plateau and vaster plains, and the mighty barrier of mountain which canalizes its landward approaches, cries aloud for the geographical study of its human history. It is now long since Sir Cyril Fox, Mr. O. G. S. Crawford and others began the detailed analysis of European geography from this standpoint. Fox's famous book on 'The Personality of Britain' set the standard for this type of research as long ago as 1932, and that book was but the climax of much previous effort. What a fascinating task awaits the Indian scholar or group of scholars who may feel moved to produce an equivalent 'Personality of India'!

And then geology. The mineral wealth of India is a familiar fact, and has been a constant stimulus to foreign trade which has, in turn, reacted upon Indian history. But

[1] F. J. Richards, 'Geographical Factors in Indian Archaeology', *Indian Antiquary*, LXII (1933), 235–43.

in dealing with generalities I would not insist unduly upon that aspect of India's 'human geology'. Civilizations of a high order have subsisted with astonishingly little mineral wealth; the Indus valley civilization of the third millennium B.C. is an example. It is rather upon geology as a localizing factor that I would dwell—both in the form of hard rock of varying tractability, and in the form of surface-soil of varying fertility. In the rocks with which the builder has constructed his tombs and temples and palaces, and in the soils which have variously attracted or repelled the grazier and the farmer, lies the primary control of geology. The fissile granite of the south, split easily by fire into great slabs, encouraged the dolmen-builder to raise his megalithic graves and shrines and partly conditioned the massive medieval temple-architecture of the same region. The Deccan Trap of the centre provided a tempting medium for the cave-cutter of the Buddhist period. And, on the negative side, in the north the scarcity of rock in the great plains encouraged there the development of the brick-building which informed the evolution of the Northern school of architecture. Or again, the fertile alluvium and loess of the Punjab and its Sind extension induced that amazing development of prehistoric urban life to which I have referred; whilst the Jumna-Ganges Doab needs no archaeologist to proclaim its civic fame.

Integral with the geographical and geological factors is that of climate, which may either enhance or neutralize other advantages, and may stimulate or narcotize human effort. In Asia, with its enormous terrain, a few inches variation in the rainfall will mean the life or death of millions of human beings, the migration of vast populations, the rise and decline of empires. The rhythm of invasion in and from central Asia has indeed been attributed unreservedly to rhythmic changes of climate, and, although the problem is a complex one still far from solution, there can be no doubt that the theory contains an important element of truth. It is manifest, for example, that the derelict cities in the desert of the Negb of southern Palestine flourished less than fifteen centuries ago in a climate considerably more equable than that which ill-sustains a few wandering Bedouin at the present day. The same phenomenon is apparent in northern Afghanistan, where Balkh, the Mother of Cities, the ancient meeting-place of routes from China, the Mediterranean and India, now as a chaotic ruin dominates a scene of almost utter desolation.[1] Or, to come nearer home, the desert of Sind where the gaunt walls of Mohenjo-daro have re-emerged from the sand must, in the third millennium, have been nourished by cyclones that have long receded northwards, thereby not only depopulating the flanks of the Indus valley (save where modern irrigation has intervened) but at the same time placing a natural and significant bulwark between southern Iran and Rajputana. It was, for instance, this bulwark of desert, more than any other factor, that barred the eastward penetration of Islam after the Arab conquest of Sind in A.D. 712.

The part played by botany in the reconstruction of human environment is obvious, dealing as it does with food-plants and their cultivation, the character and distribution of forest and jungle, and the influence upon plant-life of geographical, geological and climatic factors. But there are three points which I would emphasize in connection with botanical research. First, there is the great importance to our studies of further work in connection with the ecology or distribution of food-plants. Whatever be our definition of the term civilization, there can be no doubt that stability of food-supply is a necessary premise, and that agriculture therefore is an essential factor. Thus, in tracing the early diffusion of civilizations, we have constantly to consider the distribution of cereals, notably wheat and rice, without one or other of which human progress beyond a certain point would scarcely have been possible. Here in recent years the Russians have contributed interesting

[1] Mr. Evert Barger has recently re-directed attention to this site and to the climatic and other problems which its exploration should help to solve.—*The Geographical Journal*, CIII (London, 1944), 1ff.

data which, when amplified and verified, will have far-reaching implications in our reconstruction of Asiatic prehistory. Working from the axiom that the original home of a plant is likely to be that region where its most numerous species are found, the Russian Vavilov has discovered in Afghanistan an early home of the bread-wheat.[1] This is, for us in India, a notable fact, if true. It is remarkable indeed how often our paths of research lead us into the mists of that unknown country. We may trust that the time is now not distant when our Afghan neighbours may open their gates freely to the scholars of the world. There are hopeful signs.

The second point is the importance of the recovery from ancient soils of the evidences of the plant-life which was contemporary with them and with the human evidence which they may contain. It is over twenty years since this matter first received systematic attention in connection with humanistic studies; and now, under the lead in Britain of the University of Cambridge, the analysis of soils for the recovery and identification of plant-seeds has become a matter of routine as a sequel to archaeological excavation in the West.[2] In favourable conditions, by pollen-analysis it is now possible to recover the essential elements of the vegetation, and therefore of the climate, of remote and alien phases of the world's history or prehistory. The process is as indispensable for our studies in India as it is in Europe. But at the present time there is no laboratory in India to which we poor archaeologists can, as a matter of routine, send soil-samples for pollen-analysis. In other words, a whole avenue of research is closed to us.

My third point under the heading of botany really comes under the sub-head 'dendrology', and relates to the study of the growth of trees. Here the lead has been taken by an American, A. E. Douglass, who has successfully applied the data of tree-growth to the prehistory of man.[3] The principle is a simple one, although its accurate application involves a number of complexities. As every schoolboy knows, a section across a tree-trunk reveals a number of concentric rings of varying width, each ring representing a year's seasonal growth, which will be extensive in a wet year and restricted in a dry one. Working in western America upon trees up to 3,000 years old, and cut down at a known date, Douglass has shown the possibility of producing backwards a tree-ring time-table and climate-chart, in which can be recognized a rhythm or periodicity as shown by the varying size of the growth-rings. These periodical fluctuations approximate closely to the cycle of sun-spots, and reflect directly the fluctuations of climate which are related to that factor. In trees that have grown up in a climate with marked seasonal changes, which produce clear and accurately measurable rings, a considerable degree of precision in this tree-chronology can be achieved; to such an extent that, in a given region, it is possible to correlate the inner rings of young trees with the outer rings of old trees, and to place trees used in ancient structures into their proper place in the time-scale. Thus, though the written history of America does not begin until the end of the fifteenth century, it has been possible, by tree-ring analysis, to date a prehistoric pueblo in Arizona to A.D. 1185.

How far this remarkable method may be applicable to India I do not know: it has not been tried out, although useful basic studies in the formation of growth-rings have been

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1 N. I. Vavilov, 'Studies on the Origin of Cultivated Plants,' *Bull. Appl. Botany and Plant-Breeding*, XVI (Leningrad, 1926); Harold Peake, *The Origins of Agriculture* (London, 1928); J. B. S. Haldane, 'Prehistory in the Light of Genetics', *The Inequality of Man* (London, 1932), pp. 70ff.; A. E. Watkins, 'The Origin of Cultivated Plants', *Antiquity*, VII (Gloucester, 1933), 73ff.

2 For a general account of pollen-analysis in northern Europe, see J. G. D. Clark, *The Mesolithic Settlement of Northern Europe* (Cambridge, 1936).

3 Summarized by F. Martin Brown, 'Dendrochronology', *Antiquity*, XI (1937), 409ff

carried out here by the Forest Research Institute.[1] There is some evidence that it will be workable in West Africa, and before the war its possibilities were being explored in Europe—though there the seasonal changes are probably not sufficiently clear-cut to produce accurate results. In India, it is at least worth a serious trial.

Here, then, are three ways in which the botanist can help the archaeologist. I have not exhausted the possibilities, but have probably said enough to show that the botanist is an essential member of our team.

Biology, whether human or animal, touches our studies at many points which are familiar to us all. No sustained attempt has yet been made to trace the specific variations of the Indian fauna in relation to human chronology, and much work will, it is to be hoped, be done in this matter when the fieldworker is able to produce adequately classified material. Meanwhile there is a perennial biological problem on our door-step, whether we be archaeologist or anthropologist: the problem of the definition of the term Race. The need for an objective definition of this ill-used word is as insistent as are the difficulties in the way of solution. A quarter of a century ago the problem seemed to have been settled. The criteria of race were primarily skull-measurement, stature and coloration. The measurements of bones were standardized with great precision, and, though the recording of the colour of skin, eyes and hair remained somewhat subjective, a general all-round agreement was reached on this composite basis. I need not take you further over the well-trodden ground. But more recently these criteria have been widely questioned. There has been an increasing tendency to affirm the control of environment, not merely upon coloration, but even upon skeletal form. And alongside this growing scepticism, the value of blood-groups as race-indices has been acclaimed with a somewhat rash optimism. Here, in the composition of the blood, we have a phenomenon susceptible to objective classification, a genic character determined by heredity and not, so far as is known, affected by environment.[2] Four main blood-groups have been isolated and labelled internationally A, B, AB and O, with a number of sub-groups. The scope of this classification is not yet sufficiently clear for final judgment by the anthropologist; the task of collecting accurately grouped data is a huge one, and vast regions of Asia which are important in this context are difficult of access. But it is already apparent that blood-groups alone cannot supply the need vaguely indicated by the word Race. For instance, as Dr. D. N. Majumdar pertinently observes, 'the predominance of B in India and Mongolia inhabited by different racial stocks requires explanation'.[3] Furthermore, the speed and conditions of mutation are unknown and perhaps variable factors. And the knowledge that the higher apes possess the same blood-groups as man raises a doubt whether these mutations are sufficiently modern and sufficiently sensitive to assist the explanation of any significant human groupings within our reach. We do not at present know. It is possible that a combination of skeletal and blood-group data may eventually give us the nearest approximation to a scientific definition of Race. The problem is full of interest; more so perhaps in India than in most other parts of the world, for the variety and rigidly cellular structure of Indian society, with its traditional endogamy, offers a special scope for trying out the validity of blood-group analysis in a relatively restricted field. Exactness in the classification of data, and plenty of them, are the first requisites of this study.

Lastly in my list of sciences I come to our old friends, chemistry and physics. Old friends but in a new guise. The scientific analysis of soils and gravels has, in recent years,

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[1] K. Ahmad Chowdhury, 'The Formation of Growth Rings in Indian Trees', *Indian Forest Records (New Series), Utilization*, II, Nos. 1–3, 1939-40.

[2] J. B. S. Haldane, op. cit., pp. 63ff. ; J. Millot, 'Blood-groups and Race', *Antiquity*, IX (1935), 399ff.

[3] *Races and Cultures of India* (Allahabad, N.D.), p. 54.

been carried forward to a stage where it has become no longer a luxury but a necessity to the archaeologist. Many scientists have contributed to this study, but the protagonist has been Dr. F. E. Zeuner, a refugee from Germany under the Nazi régime and now a citizen of Great Britain. There, at the British Museum (Natural History) and the University of London Institute of Archaeology, he has developed analytical technique and collected and collated data bearing upon the environment and chronology of man from the earliest times down to comparatively recent periods. By mechanical analysis he separates sands, loams, brick-earths and other soils into individual grains and so determines their different grades or weights. The method is based upon the suspension of a certain quantity of the material in water, the coarser and heavier grains settling down more rapidly than the finer ones. In many cases it is possible to find out in this way whether the grains were deposited originally by wind or by water—a vital factor in the reconstruction of climate. For instance, comparative analyses of wind-blown dust deposited on snow, on the one hand, and of apparently identical dust from river-silt, on the other, have shown that 80–97% of the wind-blown grains are as small as 0·07–0·01 mm. or even less, whereas only about 66% of the water-deposited grains are of that minuteness. On this basis it is possible to determine by analysis the general conditions of climate, etc., under which ancient soils were laid down, i.e. the conditions of climate under which man contemporary with these soils lived.

Furthermore, by analogous methods (including chemical analysis) which I need not attempt to describe to you now, it is possible to determine whether a deposit has been subjected to secondary weatherings. In other words, it is possible to reconstruct objectively a *climatic sequence*, important not merely in itself but as facilitating a comparison between analyses from different regions and so producing a chronological relation between those regions; the essence of the comparison being that an extensive and complex sequence of climatic changes occurring at similar intervals in two regions may be taken to imply approximate contemporaneity for the two series of deposits.

Similar to mechanical analysis is gravel-analysis. It is common knowledge that the earlier phases in the story of man are interleaved or punctuated by the emphatic incidence of climate of arctic or pluvial type, which may itself be diversified in a multiplicity of ways. The most informative index of these climatic variations and sub-variations is provided by successive river-beds or terraces, and the analysis of samples of gravels from the different terraces of the same river is capable of producing a remarkable body of information. The gravel is passed through a set of sieves of graded mesh and is thus itself graded according to size. Each grade of the gravel is then sorted into the different varieties of rocks and minerals composing it, and the result is usually represented in percentage figures. These figures may yield the following information[1]:—

(1) Any alteration of the catchment area, and the relative period of each alteration.

(2) The date of volcanic events in relation to the sequence of terraces.

(3) The relative age of glaciations which invaded, or touched, the river area; detected by the introduction of the pebbles of foreign rocks.

(4) In certain river areas, where the gravel is of a varied character, the composition of the gravel can be reproduced in the form of a curve showing the respective frequencies of the components in the various grades. The form of the curve is influenced by climate during the deposition of the gravel: in a dry climate hard but chemically little resistant rocks (like felspar) survive even into the

[1] I am abbreviating from F. E. Zeuner, *First Annual Report of the University of London Institute of Archaeology* (London, 1937), p. 42. See also same author, *Dating the Past: an Introduction to Geochronology* (London, 1946).

small grades, whereas in a wet climate chemical action is brought to bear and rapid destruction ensues.

When studying systems of river-terraces in this way, we may expect to arrive at a detailed sequence of climatic events, with (in favourable circumstances) fossil human industries closely correlated with them. And this evidence has in a number of cases been equated with the parallel evidence of soil-analysis; so that, in the aggregate, a firm sequence of climatic phases and human cultures has been worked out in those regions which have been adequately studied.

But the marvels of Geochronology, as this new application of chemical and physical analysis to humanistic science has been called, do not end there. I have spoken so far only of the *relative* chronology which the study of these sequences has produced. Already, however, this technique is reaching beyond the relative to the absolute. 'The climatic fluctuations which have been established, based on the work of a great number of authors on loess-sections and river-terraces, have surprisingly been found to agree closely with certain fluctuations of the intensity of solar radiation, calculated on an astronomical basis. This enables one to arrive at probable approximate dates for the palaeolithic cultures.' By dates in this context are meant *absolute* dates, a fixed chronology. Thus it has been deduced provisionally that the oldest palaeolithic culture of Europe flourished approximately from 550,000 to 470,000 years ago, and an absolute time-table for the later cultures, in relation to glacials and inter-glacials, has also been worked out.[1] The method is still in the experimental stage, but it represents a line of advance which deserves further exploration.

Now how does India come into all this? At present not at all. But the raw material is here in abundance. We have great rivers, rivalling those of Europe. We have ancient industries, often resembling closely those which, in Europe, Dr. Zeuner and others are beginning to put into a time-scale. If we have not the same wealth of glacial material which sub-Arctic Europe accumulated, we have evidences of pluviation which await analytical correlation with the pluvials of Africa and, indeed, with the glaciations or inter-glacials of Europe itself. Meanwhile, in the absence of geochronological research here, we have no right to apply to India, even provisionally, the results of European investigation. We must stand upon our own feet—or, rather, we must get going upon our own feet—prepared for the possibility that India may extract from these methods a different answer altogether. Be that as it may, the roots of mankind in this sub-continent, extending downwards probably for hundreds of thousands of years, can never be studied adequately until somewhere in india we set up a geochronological laboratory and train some of our best young scientific brains to work it.

Well, there we have an imposing array of sciences, all of which contribute to our special studies, and, furthermore, none of which can nowadays be neglected in them. I have said nothing of what may be called the more domestic technique of archaeology itself, and I am not sufficiently experienced as an anthropologist to venture into the special problems and methods of that sister-science. In archaeology, much could be said nowadays of the increasing subtlety of the technique of excavation; and much, above all, of the essential value of air-observation and air-photography in archaeological fieldwork, particularly in a country such as India with its vast spaces, often difficult of approach on the ground. Who knows what a systematic air-survey of the Thar or Indian Desert might reveal, or of the great plains themselves with their teaming vestiges of age-long habitation? The time has come for something more than attractive obliques of the Tāj Maḥāl. The taking and interpretation of air-photographs is today in itself an evolved technique. In the north-

[1] F. E. Zeuner in *The Geological Magazine*, LXII (London, 1935), 361ff.

west, the new Royal Indian Air Force has already taken a number of excellent photographs for my Department. Once more, the ability is there, but it needs stimulus and coordination. It is now thirty years since the Germans led the way in this 'archaeology from the air', and over twenty years since air-photography was first generally recognized as a necessary concomitant of archaeological research in Great Britain. In Palestine and Iraq the most dramatic results have been yielded by this method of detection and correlation. Let us get air-archaeology going in India, not in the opportunist fashion in which it is on very rare occasions operated at the present time, but on an organized, carefully thought-out plan. On such a basis we may reasonably expect, I think, cooperation from the Survey of India, from the R.I.A.F., and also before long, it is to be hoped, from Indian civil aviation.

There then, in the barest outline, are the main factors for consideration in planning the future of the study of the material heritage of India. The problem is a formidable one but not impossible of solution. It is evident, as I remarked earlier, that the primary need is not for scattered lectureships of a more or less amateur kind sprinkled broadcast over the academic landscape, though these might ultimately have a certain utility in a secondary sense. *The real need is for a centralized school of archaeology of a highly specialized kind.* Without that we cannot hope to raise humanistic science in India to the international level which is its rightful place. But let us not despair before the prospect of so much concentrated specialization, or the immense budget which that might seem to imply. At the present time one of the more popular slogans is 'coordination'. All over the world we find coordinating committees, with super-committees to coordinate them in turn. And now, in our particular need, *coordination* supplies a great part of the answer. Most (not all) of the sciences to which I have referred are already being taught and studied in many of the Indian universities. What is needed is that in some one of our universities these departments of science shall be in a measure adapted specifically to the requirements of humanistic research: that geologists, for example, may be persuaded to give more attention than at present to tertiary and quaternary geology, even though it be of less immediate economic value and, incidentally, more elusive and difficult in itself; that botanists may develop the technique of pollen-analysis and the further investigation of plant-ecology in relation to human problems; that somewhere in a physical laboratory a section may be set aside for the analysis of soils and gravels. All this can be achieved by a relatively slight expansion of present equipment and enterprise. But behind it all must be the trained archaeologist busy in the blessed act of 'coordination'; stimulating, inspiring, driving, even wheedling, his fellow-scientists into a combined concern in this great central study of mankind, Man. The modern archaeologist—and I have no doubt that the same thing applies to the modern anthropologist—must be as much a diplomat as a scientist. He must be a scholar, he must be an organizer amongst busy men, he must be a leader and not least, his directed enthusiasm must be such as to ensure the cooperation of his colleagues and the creation of a following of worthy shape and size. He must be employed by a university equipped with scientific departments and sympathetic to humanistic studies. He must obviously for a while be sent abroad for such technical training as his country may not yet be in a position to provide. In due time he will require the assistance of a small departmental staff. These various desiderata are easy to set down on paper; but they are also not difficult or disproportionately costly to realize in fact. Amongst the youth of India there is, as I well know, the zest to learn and the ability to achieve. It is for us of an older generation to provide the essential apparatus and the necessary opportunity. Let us not fail. Now, I submit, is the time to act.

R. E. M. W.

TECHNICAL SECTION

2. ARCHAEOLOGICAL PHOTOGRAPHY

By SQUADRON-LEADER M. B. COOKSON, R.A.F.

It is unnecessary to stress the high importance of good scientific photography; nevertheless, inadequate photographs are excessively abundant in archaeological reports, and these notes may be of use as a reminder of some of the essential factors involved. Squadron-Leader Cookson has had many years' experience as a photographer to archaeological expeditions and as an instructor in archaeological photography.

A.—GENERAL

1. To-day lenses, cameras and material can be accepted as almost perfect. The standard of photography depends therefore upon the knowledge and judgment of the individual photographer more than upon his equipment. We may have complete confidence in our materials; it remains to understand fully how much can be done with them, i.e. in what way we can press these tools into the fullest service. Accepting that camera-manipulation is now automatic, then the whole of the mind can be given to the production of a photograph which (*a*) is a good, sharp, clear record, (*b*) tells at a glance what has happened in the archaeological sequence, (*c*) has artistic merit, and (*d*) having all these things becomes, on reproduction in the final report, a piece of work to which to turn with pride.

2. Assuming that the finished photograph has all these things, let us look back and see how the result was achieved. It was not done alone; it involved co-operation with site-supervisors, knowledge of the site and all its peculiarities, the maintenance of photographic site-notebooks for personal reference, and keeping up-to-date with work. The notebooks will also provide data for future photographs and possible retakes, since it will contain all details relating to time, position, exposure and filter used. Thus:—

Ranchi
Site E. Sect. X. South face
11·45 hrs. Strong sunlight
10″ lens. Red filter. F. 22. 3 secs.

B.—EQUIPMENT

3. The archaeological photographer in the field needs the following equipment:—

1. Stand camera (for full plate, half plate and quarter plate).
2. Four lenses (short, middle and long focus, and telephoto).
3. Three filters (green, yellow and red).
4. Bubble-level.
5. Assorted scales, including two or three small scales divided into inches and centimetres.
6. Pair of scissors.
7. Lump of plasticine.
8. Exposure metre.
9. Pocket camera and spare films.
10. Sheet of glass for photographing small finds.
11. Sheet of black velvet for ditto.
12. Notebook.

C.—Administration and Record Keeping

4. Another essential is ease of access to negatives, and, to this end, all negatives made and approved should be numbered with a Serial No., orientation, the page in the site-supervisor's notebook, and, if possible, the position on the site and the general plan or the Drawing No. (see below). It is quite simple to do all this in the rebate or margin made by the dark slide, and the work should be carried out with waterproof ink and a mapping pen. If celophane envelopes are used for storing negatives, then the same details will be added to the envelope, together with the type of printing paper used in the print produced. Thus, if the Negative Register is ever lost or destroyed, the details would still be available. In the same manner the keeping of a *Negative Register* is essential, columnized to receive all the foregoing details but with an added 'Remarks' column in which notes can be made of such matters as the existence of lantern-slide negatives of the same subject, or whether the negative has been used for publication, the date and reference of publication being given.

DIAGRAMMATIC EXAMPLES

NEGATIVES

237. RANCHI. SITE E. SECT. X.

N.B. 10. P. 41. DRWG. No. 15.

NEGATIVE BAG

237

RANCHI

SITE E. SECT. X

SOUTH FACE HUMUS REMOVED

NOTEBOOK 10. P. 41

DRWG. No. 15

KODAK BROMIDE GRADE 5

10 SECS.

NEGATIVE REGISTER

RANCHI

Neg. serial	Site	Section	Drwg. No.	Sup. N. Bk.	Remarks
237	E	X South face	15	10 P. 41	Humus removed. Interim Report pl. CX. Lantern-slide made.

D.—Exposure and Printing

5. *Exposure.*—It is preferable to *over*-expose a plate or film rather than to *under*-expose it.

Except for a highly experienced photographer, it is wrong to under-develop, because a fully-exposed negative, fully developed, can be reduced chemically, or a different speed of printing paper may be used to correct a dense negative.

6. *Printing paper.*—The quality of the negative decides the type of printing paper to be used. There are four kinds of printing paper, and their use is as follows:—

(1) *Soft grade paper*, used for hard, somewhat dense negatives in which the high lights are clogged or dense and the shadow-detail obscured.

(2) *Normal grade paper*, used for a normal negative with average tone-values.

(3) *Contrast grade paper*, used when negatives lack adequate contrast between high lights and shadows.

(4) *Super-contrast paper*, used with thin, weak negatives, or for printing photographs of outline plans and drawings.

7. *Glazing.*—For purposes of reproduction, prints should be glazed. This can be done by (*a*) hardening them in a saturate solution of alum or a 20% formalin bath; (*b*) then rewashing them in water; (*c*) then placing

them face-down on a clean and well-polished sheet of glass until dry. If they stick to the glass, prints can be removed without damage by soaking the back in water; this will save the print but will remove the glaze.

8. *Halation.*—When photographing within 45 degrees of the sun, it is essential to shade the lens during exposure to avoid halation. A hat or book or sheet of cardboard will serve the purpose.

9. *Levelling.*—It is important that, before exposure, the base of the camera should be *carefully levelled* in both directions with a bubble-level.

E.—Lenses

10. There is a general tendency to use lenses with too wide an angle or too short a focal length. Such lenses facilitate the inclusion of the subject within the limits of the plate, but only by sacrificing true scale and perspective. A wide-angle lens will flatten and distort the subject, and so falsify it and generally weaken it. The golden rule is to use a lens with as *narrow* an angle as possible, i.e. with as long a focal length as possible.

It is recommended that not less than *three* lenses be included in the equipment of the archaeological photographer for a whole-plate camera, e.g. (1) 7 to 8 inches focal length (wide angle); (2) 9 to 9½ inches focal length (medium angle); 12 to 14 inches focal length (narrow angle). A telephoto lens is a useful addition.

F.—Filters

11. The photographer must be prepared to use filters or colour-screens to emphasize certain groups of colours, e.g. in photographing a stratified deposit. The use of filters necessitates a longer exposure according to the colour used. The following filters should be included in the equipment:—

(1) Green filter, necessitating an exposure 6 times as long as the normal.
(2) Yellow filter, necessitating an exposure twice as long as the normal.
(3) Red filter, necessitating an exposure 4 times as long as the normal.

The above multiplying factors apply only when panchromatic or red-sensitive plates are used. With orthochromatic or yellow-sensitive plates, only green or yellow filters are effective, and the multiplying factors are as follows: with green filter, the exposure will be 9 times the normal; with yellow filter it will be 5 times the normal.

The general effect of the green filter with panchromatic and orthochromatic plates is to eliminate greens and yellows and thus to emphasize reds and blacks. The yellow filter with panchromatic plates will reproduce colours with the tone-values observed by the naked eye. With orthochromatic plates it will lighten yellows up to light orange, and will darken all blues. The red filter (used only with panchromatic plates) will lighten all reds and yellows, darken all greens and blues, and will separate red from black.

G.—Scales

12. The importance of a scale or scales in photography cannot be over-emphasized. Whether the photograph be a general view or a 'close-up' for minute detail, a scale should always be added, placed in such a manner that it is unobtrusive, yet there when required. A formula for scaling cannot be laid down, but there are one or two points which should be observed:—

(i) A large general view of the site may require three survey poles, placed respectively in the foreground, the middle distance and the far distance, in order that each portion of the photograph may have its own appreciation of size, according to its distance from the lens.
(ii) A close-up or a small area will require only one survey pole.
(iii) 'Finds' such as pots *in situ*, small ironwork and other small objects will require only a small scale.
(iv) The scale can be easily constructed of wood painted alternately black and white, carefully sectioned in inches or feet, centimetres or metres.
(v) It is important that an upright scale should *appear vertical in the photograph.* If the camera is tilted the scale will have to be tilted proportionately.

It remains then that each photograph must have a scale, and that the scale should be suitable to the type of photograph, the guide being common sense and a sense of what looks correct. Should the human figure be used, IT MUST HAVE THE APPEARANCE OF BEING EMPLOYED, i.e. should not be staring at the camera but should be posed in the action of doing something. Neither should it be exactly in the centre of the picture, but slightly to one side. In all cases there MUST be a scale, whether human or linear.

H.—Lantern-slides

13. If care must be taken in making a negative or a print, even greater care must be taken in making lantern-slides, by reason of the very great enlargement which takes place in their showing. A lantern-slide may be regarded as a photographic print on glass, but the actual size is now only 3¼ inches, whilst its ultimate projection may become 9 or 10 feet on the screen or at least 40 diameters. The slightest dust-spot or pinhole is therefore enlarged at least 40 times.

14. There are two methods of making lantern-slides from ordinary negatives; either to re-photograph a good print on a lantern-slide negative, or to reduce the original negative to lantern-slide size in an enlarger.

Lantern-slides are made from book illustrations, etc., by photographing on a lantern-slide negative.

15. To avoid eye-strain and keep attention, the tone of the slides should not be kept to black and white, but should vary with the type of picture, brown or sepia being used for suitable subjects.

16. When a particular slide is required more than once during the same lecture, it is preferable to have duplicate slides inserted in the correct places to enable the lecturer to proceed smoothly without waiting or fumbling for a previous slide.

17. All slides should be viewed, if possible, through the lantern before being handed over to the lecturer.

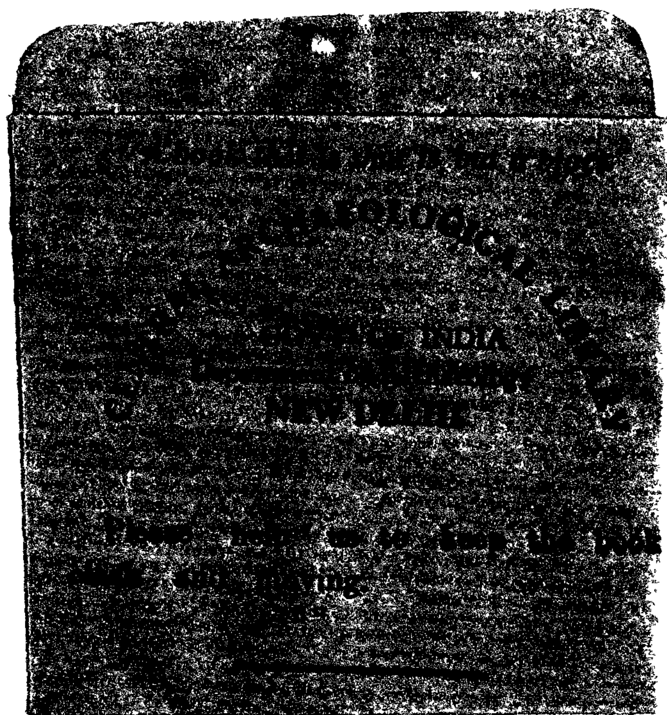
18. Slide negatives can always carry the original negative number, and an indication that a slide has been made should be included in the negative register.

I.—Conclusion

19. In the foregoing notes the *importance* of the work of the photographer has been stressed. Almost everything depends on good craftsmanship and pride in the production of first class photographs. The final photograph appears in published form and may go into every corner of the scientific world; therefore it has to be perfect. It must tell its story at a glance, it must be technically correct, it must be a first-class print from a first-class negative. A good clear record, if possible with artistic merit, can only be obtained by constantly watching the site, the changes made by a changing light on the subject, absolute cleanliness, and care and attention to small details; precision, fidelity and sincerity in all work, and justifiable pride in the knowledge that your photograph is an essential factor in the science which you serve.

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